STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

STEVEN E. CHESTER
DIRECTOR

June 22, 2005

Mr. Richard C. Karl, Director
Superfund Division
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604

Dear Mr. Karl:

We are pleased to provide you with the Second Five-Year Review Report (Report) for the Sturgis Municipal Wells Superfund Site in Sturgis, St. Joseph County, Michigan. This document was prepared by the Michigan Department of Environmental Quality (MDEQ), with assistance provided by the U.S. Environmental Protection Agency (U.S. EPA), Region 5, Superfund staff.

A joint signature page has been prepared for this Report. After you have signed the document, please forward a copy of the signature page to Mr. Robert L. Franks of my staff. Mr. Franks may be reached at 517-335-3392.

It has been a pleasure to work with your staff on this project. If you have any questions or comments, please contact me.

Sincerely,

Andrew W. Hogarth, Chief
Remediation and Redevelopment Division
517-335-1104

Enclosure

cc: Mr. Pablo Valentin, U.S. EPA
Ms. Rosita Clark-Moreno, U.S. EPA
Ms. Elizabeth M. Browne, MDEQ
Mr. David A. Kline, MDEQ
Mr. Robert L. Franks, MDEQ

Second Five-Year Review Report

for

Sturgis Municipal Wells Superfund Site

Sturgis, St. Joseph County, Michigan

May 2005

PREPARED BY:

Michigan Department of Environmental Quality
Lansing, Michigan

Approved by: Date:

Richard C Karl — 6-30-05

Richard C. Karl, Director
Superfund Division
U.S. Environmental Protection Agency, Region 5

Andrew W. Hogarth — 6/21/05

Andrew W. Hogarth, Chief
Remediation and Redevelopment Division
Michigan Department of Environmental Quality

Five-Year Review Report

Table of Contents

List of Acronyms

BMDL	*Below Method Detection Limit*
CD	Consent Decree
CERCLA	*Comprehensive Environmental Response, Compensation and Liability Act*
DCA	Dichloroethane
DCE	Dichloroethylene
DNAPL	Dense Non-Aqueous Phase Liquid
GC	gas chromatograph
GPM	Gallons Per Minute
MDEQ	Michigan Department of Environmental Quality
MDPH	Michigan Department of Public Health
NCP	National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300)
NPDES	National Pollutant Discharge Elimination System
NPL	*National Priorities List*
NREPA	Natural Resources and Environmental Protection Act
O&M	Operation and Maintenance
PAH	Polynuclear Aromatic Hydrocarbons
PCE	Tetrachloroethylene
ppb	parts per billion
PRP	Potentially Responsible Party
RA	Remedial Action
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SVE	Soil Vapor Extraction
TCA	Trichloroethane
TCE	Trichloroethylene
UAO	Unilateral Administrative Order
U.S. EPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

Executive Summary

The Sturgis Municipal Wells site is located in the city of Sturgis, Michigan. The city is located in south central Michigan in St. Joseph County, approximately two miles north of the Indiana state line, halfway between the Chicago and Detroit areas. The majority of the city lies within the political confines of Sturgis Township, while northern, northeastern, and eastern portions of the municipal area lie within the Sherman, Burr Oak, and Fawn River Townships, respectively. The city encompasses approximately five square miles and approximately 10,000 people reside in the city. The city's economic base is largely industrial.

Table 1, within this report, lists an extensive site chronology. In summary, contamination in city of Sturgis municipal production wells was discovered in 1982. The site was placed on the National Priorities List (NPL) in 1984. A remedial investigation and feasibility study, financed by a federal grant, and conducted by the State of Michigan from 1987 to 1991, revealed two sources of the contaminated groundwater and massive groundwater contaminant plumes in at least two aquifers beneath Sturgis. A Record of Decision (ROD) was issued in 1991 that called for, among other things, pumping and treating the contaminated groundwater and soil vapor extraction (SVE) of the Kirsch source area soils until state cleanup criteria are achieved. An interim pump and treat system was constructed by the potentially responsible party in 1994 and has been operational since that time. A ROD amendment was issued in 1996 that changed some components of the remedy as well as modified the cleanup criteria. The SVE was conducted at the Kirsch source area from 1996 to 2000. Additional groundwater pump and treat systems were installed in 2001 and 2003, and are anticipated to be the final remedy for groundwater at the site.

The Michigan Department of Environmental Quality (MDEQ) conducted the first five-year review in 1999, prior to completion of the SVE remedy or construction of the final groundwater remedy. This five-year review then represents the first opportunity to review the site since complete remedial action (RA) implementation. This review found that, while some minor modifications to the remedy may be necessary, the site and its remedies are expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, which is expected to require 20 to 30 years to achieve. In the interim, exposure pathways that could result in unacceptable short-term risks are being controlled.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name *(from WasteLAN)*: **Sturgis Municipal Wells**

EPA ID *(from WasteLAN)*: **MID980703011**

Region: 5	**State: MI**	**City/County: Sturgis, St. Joseph**

SITE STATUS

NPL status: [X] Final [ ] Deleted [ ] Other (specify)

Remediation status (choose all that apply): [ ] Under Construction [X] Operating [ ] Complete

Multiple OUs? [ ] YES [X] NO | **Construction completion date:** 9/3/1997

Has site been put into reuse? [ ] YES [X] NO

REVIEW STATUS

Lead agency: [ ] EPA [X] State [ ] Tribe [ ] Other Federal Agency _____

Author name: Robert L. Franks

Author title: Project Manager | **Author affiliation: MDEQ**

Review period: 9/15/2004 to 12/15/2004

Date(s) of site inspection: 9/27/2004

Type of review:

[ ] Post-SARA [ ] Pre-SARA [ ] NPL-Removal only
[ ] Non-NPL Remedial Action Site [X] NPL State/Tribe-lead
[ ] Regional Discretion

Review number: [ ] 1 (first) [X] 2 (second) [ ] 3 (third) [ ] Other (specify) _____

Triggering action:

[ ] Actual RA Onsite Construction at OU #____
[ ] Actual RA Start at OU#____
[ ] Construction Completion
[X] Previous Five-Year Review Report
[ ] Other (specify)

Triggering action date *(from WasteLAN)*: 10/15/1999

Due date *(five years after triggering action date)*: 9/30/2004

Five-Year Review Summary Form, cont'd.

Issues:

1. Need to confirm chemical capture in downgradient portion of the plume, especially near monitoring well W-44.
2. Lack of information regarding the basal till/bedrock valley east of extraction well EW-1.
3. Lack of recent residential well and monitoring well data downgradient of deep aquifer contaminant plume at White School Road.
4. Need to utilize some or all of the Ross Labs monitoring and production wells, as well as other existing monitoring points for semi-annual groundwater monitoring.
5. Methodology for cleaning the air strippers presents risks of its own, due to the large volume of acid used.
6. The ROD relies upon the county well permitting program to prevent human exposure to the groundwater contamination. However, no map of geographic locations that should be prohibited from installation of drinking water wells exists for health agency staff to consult when they receive applications for well permits.

Recommendations and Follow-up Actions:

1. The MDEQ needs to determine if modifications or additions to the groundwater pumping systems are necessary to begin to lower the trichloroethylene (TCE) levels at the W-44 monitoring point.
2. The MDEQ and Newell-Rubbermaid need to agree on the best way to gather information on the eastern portion of the basal till/bedrock valley, in a manner that is mutually acceptable.
3. The MDEQ and Newell-Rubbermaid need to evaluate adding residential wells and monitoring wells on White School Road to the long-term groundwater monitoring plan.
4. The MDEQ should work with Newell-Rubbermaid to determine which Ross Labs wells and other existing monitoring points should be added to the monitoring network and then take steps to secure long-term access to those wells.
5. Newell-Rubbermaid should consult with the MDEQ Water Bureau to identify potential additives that might prevent or limit the buildup of calcium carbonate in the stripping towers and associated plumbing.
6. Need to work with Branch/Hillsdale/St. Joseph community health agencies to establish a map of geographic locations that they may use to determine locations prohibited from obtaining approval for the installation of drinking water wells.

Protectiveness Statement(s):

The remedy is protective in the short-term because actions to date prevent current exposures. In the long-term, the site and its remedies are expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, which is expected to require 20 to 30 years to achieve. In the interim, measures will be taken to prevent unacceptable exposures by providing local authorities with maps to better discern geographic locations for which the installation of residential drinking water wells would be forbidden.

The RAs undertaken at the Sturgis Municipal Wells site have been consistent with those chosen in the ROD and ROD Amendment. The SVE at the Kirsch source area has substantially achieved remedial objectives. Subsequent actions have been undertaken to address the residual contamination existing immediately above the water table. Once contaminants are removed from this area, RA objectives will then be met for the soils portion of this site.

The groundwater RAs undertaken at the site have created a zone of influence in the deep aquifer that has resulted in the western migration of a groundwater divide, such that the identified contaminant plume is now entirely on the eastern side of the divide. Groundwater flow on the eastern side of the groundwater divide is toward the extraction wells. Chemical capture may be complete; but if not, will be complete with minor modifications to the pumping strategy or system components.

Five-Year Review Report

I. Introduction

The Purpose of the Review

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and recommendations to address them.

In May 1994, construction of an interim pump and treat system was completed. The first five-year review, which was a policy review, was conducted by the Michigan Department of Environmental Quality (MDEQ) in October 1999, approximately five years after construction completion of the interim pump and treat system. This second five-year review is conducted approximately five years from the last five-year review. This five-year review is required by the United States Environmental Protection Agency (U.S. EPA) policy. Future five-year reviews will be necessary since hazardous substances, pollutants or contaminants remain at the site above levels that allow for unrestricted use and unlimited exposure.

Authority for Conducting the Five-Year Review

The agency is preparing this five-year review pursuant to Comprehensive Environmental Response, Compensation, and Liability Act, 1980 PL 96-510 (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Who Conducted the Five-Year Review

The MDEQ has conducted a five-year review of the remedial actions (RAs) implemented at the Sturgis Municipal Wells site in Sturgis, Michigan. This review was conducted from September 2004 through December 2004.

Other Review Characteristics

This is the second five-year review for the Sturgis Municipal Wells site. The triggering action for this review is the date of the previous five-year review, as shown in the U.S. EPA's WasteLan database: October 15, 1999. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unrestricted use and unlimited exposure, consistent with the U.S. EPA policy.

II. Site Chronology

TABLE 1
Site Chronology
Sturgis Municipal Wells Superfund Site

Date	Activity
1982	Routine sampling by Michigan Department of Public Health (MDPH) reveals two of four city water production wells contaminated with trichloroethylene (TCE) and tetrachloroethylene (PCE).
1983	Industrial water wells in the northwest portion of the city are found to be contaminated with TCE and PCE.
October 1984	The site is placed on the National Priorities List (NPL). It is decided that the MDEQ would be the lead agency for remedial investigation/feasibility study (RI/FS) activities.
1984	The city of Sturgis begins using a new well, bringing the total to three usable wells (the Broadus, Lakeview, and Oaklawn wells) and two contaminated wells (the Layne and Jackson wells).
1985	The Broadus well was found to be contaminated.
September 1987-May 1991	The RI/FS is conducted. Results of the RI document large plumes of TCE and PCE in at least two aquifers, and contaminated soils in two source areas (the Kirsch and Wade properties).
1989	The city of Sturgis installs a sixth municipal well, the Thurston Woods well.
September 1991	The U.S. EPA issues a Record of Decision (ROD) for the site. The selected remedy included extraction and treatment of groundwater and soil vapor extraction (SVE) of source area soils, and excavation of the remaining contaminated soils that cannot be treated by SVE.

1992	The U.S. EPA designs an interim groundwater pump and treat system to halt the migration of contaminants toward uncontaminated city municipal wells. The U.S. EPA issues a Unilateral Administrative Order (UAO) to a potentially responsible party (PRP), Cooper Industries for completion of the interim response.
Early 1993	The U.S. EPA and the MDEQ enter into settlement negotiations with liable parties for the Remedial Design (RD)/RA of the ROD remedies. These negotiations were unsuccessful. The U.S. EPA decides to fund the RD/RA with the MDEQ as the lead agency.
Late 1993	The liable party begins construction of the interim pump and treat system.
May 1994	Construction of the interim pump and treat system is completed. Pumping of extraction well 1 (EW-1) at a rate of 3,000 gallons per minute (gpm) commences.
Fall 1994	The MDEQ's consultants conduct pre-design investigations. Soil sampling and deep aquifer drilling is conducted.
1995	The SVE system design is conducted by the MDEQ consultants.
1996	The MDEQ enters into settlement negotiations with Cooper Industries for their takeover of the RD/RA. Negotiations are successful.
1996	The U.S. EPA issues a ROD Amendment for the site, which changes groundwater and soil cleanup standards to comply with current state regulations. The ROD Amendment also eliminated the Wade source area from SVE and eliminated requirement for soil excavation due to changes in cleanup criteria.
December 1996-March 1997	Kirsch SVE system is constructed.
March 1997-May 2000	Kirsch SVE system is operational.
1997	The Kirsch Division of Cooper Industries is purchased by Newell-Rubbermaid. Newell-Rubbermaid assumes responsibility for the cleanup of the site.
January 1999	The MDEQ determines that the interim pump and treat system must be augmented to achieve complete capture of the western portion of the deep aquifer groundwater plume, and to prevent further plume migration to the industrial supply wells in the northwest portion of Sturgis. The MDEQ requests that Newell-Rubbermaid design, install, and operate an additional groundwater pump and treat system.
Spring 2001	Cleanup verification sampling of Kirsch source area soils is conducted. A subsequent report is submitted by Newell-Rubbermaid which concludes that cleanup has been achieved. The MDEQ disagrees with that conclusion. Discussions between the MDEQ and Newell-Rubbermaid are undertaken to resolve the issue.
2002	The city of Sturgis begins using a second well installed in Thurston Woods Park.
March 2002	Construction of the additional pump and treat system (designated as the EW-2 system) is completed.

May 2002	Full time operation of EW-2 commences, at a pumping rate of 2,000 gpm. A simultaneous decrease in the pumping rate of EW-1, to 1,100 gpm is approved by the MDEQ.
May 2002	Agreement is reached between the MDEQ and Newell-Rubbermaid to undertake the design, construction, and operation of a shallow aquifer groundwater extraction well near the Kirsch source area. This agreement resolves issues related to the residual soil contamination at the Kirsch source area.
November 2003	Construction of the shallow aquifer extraction well (EW-3) is completed. Full time operation of the well commences.

III. Background

Physical Characteristics

The Sturgis Municipal Wells site is located in the city of Sturgis, Michigan. The city is located in south central Michigan in St. Joseph County, approximately two miles north of the Indiana state line, halfway between the Chicago and Detroit areas. The majority of the city lies within the political confines of Sturgis Township, while northern, northeastern, and eastern portions of the municipal area lie within the Sherman, Burr Oak, and Fawn River Townships, respectively. The city encompasses approximately five square miles and approximately 10,000 people reside in the city. The city's economic base is largely industrial.

Land and Resource Use

The aquifer beneath the city is the sole source of drinking water for the city's residents and numerous industries. Several groundwater production wells in the city have become contaminated with TCE or PCE and have either been shut down or used for non-consumptive purposes.

Two source areas have been identified as responsible for the aquifer contamination: The Kirsch Company Plant No. 1 property and the former Wade Electric Property.

The Kirsch property consists of a vacant manufacturing facility, an active 800 call center for Newell-Rubbermaid, and a vacant lot. Manufacturing at this location ceased in 1980. Most of the manufacturing facilities previously located on the vacant lot have been demolished.

The Wade Electric property is currently occupied by a sporting goods retailer. The Wade Electric facility, which manufactured electrical components for the auto industry, closed in 1966 and burned down in 1974.

Groundwater flow in the shallow aquifer is generally toward the center of the city, to a till window which acts as a drain from the upper to the lower aquifer. Groundwater flow direction within the lower aquifer is regionally toward the west, northwest or southwest, and is modified locally by the pumping from municipal, industrial, and extraction wells. When the EW-1 and EW-2 extraction wells are pumping, a pronounced cone of depression is produced, with drawdown in the deep aquifer observed over one mile from the pumping sources.

History of Contamination

Routine sampling by the MDPH in 1982 revealed two of the four municipal water supply wells serving the city of Sturgis were contaminated with the industrial solvents TCE and PCE. In 1983 the city asked residents in its service area to limit their water usage. In 1983 industrial supply wells in the northwest portion of Sturgis became contaminated with TCE and PCE. In 1984 the city began utilizing a new well (the Oaklawn), bringing the total to three usable wells (the Broadus, Lakeview, and Oaklawn) and two contaminated wells (the Layne and Jackson). In 1985 the Broadus well was found to be contaminated. In 1989 the MDPH advised the city not to rely on the Layne, Jackson, and Broadus wells. The city is now relying on the Oaklawn and two wells installed in Thurston Woods Park to serve their needs.

It is believed that solvent handling practices during manufacturing and maintenance led to the TCE and PCE contamination in the soil and groundwater. It is also possible that the releases may have occurred as a result of leaking solvent holding tanks.

Initial Response

In August and September 1982, the MDPH suggested that the city discontinue using the two contaminated municipal wells, undertake an investigation in an attempt to locate the source of volatile organic compound (VOC) contamination, and explore the possibility of locating alternate well field sites. In October 1982, the city initiated attempts to identify the VOC source area and commissioned Gove Associates to identify the source of contamination. In December 1982, the city began the process of identifying additional well field sites. By May 1983, the VOC source area investigation by Gove Associates had ended with the city unable to locate the contamination source or plume.

Basis for Taking Action

The site was placed on the NPL in 1984. It was decided that the MDEQ would lead the RI/FS, funding for which would come from a federal Superfund grant from the U.S. EPA. The RI/FS was conducted in three phases (Phases I, II, and IIB) from September 1987 to May 1991.

Remedial Investigation

Specific activities conducted include:

Phase I

- An industrial survey was conducted to gather information pertaining to current and past use of chlorinated solvents, and to obtain knowledge of the general industrial processes and practices of the facilities.

- Sampling and field analysis of 28 existing monitoring, industrial or municipal wells.

- 185 soil gas samples were collected and analyzed to help identify potential VOC source areas, and to assist in locating the VOC plume in the water table aquifer.

- Installation of 17 monitoring wells was completed during Phase I. The wells were installed to provide data on aquifer characteristics, groundwater quality, and groundwater flow directions.

- Groundwater sampling and analysis was conducted to monitor the extent of the contaminant plume in the water table aquifer.

- Split spoon soil samples were collected at each drilling location and were analyzed by field gas chromatography (GC) using a headspace analysis method.

Conclusions drawn from Phase I:

- The sand and gravel aquifers utilized by the city and industry appear to be extensive throughout the city. Up to three relatively low permeability silt or clay deposits are present.

- Groundwater flow in the lower portion of the aquifer appears to be dominated by the position and pumping rate of the municipal and industrial water supply wells.

- The soil gas survey detected measurable concentrations of VOCs at numerous locations throughout the city, with the highest concentration being found on the property of Kirsch Company Plant 1 (338,720 micrograms per liter (ug/L)). Several locations with TCE and/or PCE were investigated further with monitoring wells, including Wade Electric, Sturgis Newport Business Forms, Telemark Business Forms, and Kirsch Plant 1.

- Soil samples collected during drilling were analyzed using field GC methods. Of the 43 samples collected and analyzed, 25 had detectable levels of VOCs. Compounds detected included TCE, PCE, 1,1-dichloroethylene (1,1-DCE), 1,2-dichloroethylene (1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,2-dichloroethane (1,2-DCA), toluene, benzene, and methylene chloride.

Phase II

- 37 monitoring wells were installed to further characterize the quality of groundwater.

- 118 soil gas samples were collected to further characterize potential source areas identified in Phase I. Maximum concentrations found for each potential source area included: Wade Electric, 5.8 µg/L TCE, 1.04 µg/L PCE, and Kirsch Company Plant 1, 1195 µg/L TCE, below method detection limit (BMDL) for PCE.

- 296 soil samples were collected and analyzed for VOC content. The highest concentrations of VOCs detected in soil were found at Kirsch Company Plant 1, where 173 milligrams per kilogram (mg/kg) TCE, and 4.2 mg/kg PCE were found. Maximum VOC concentrations at Wade Electric were 50 µg/kg TCE and 150 µg/kg PCE.

- 87 water quality samples were collected and analyzed, using field GC headspace methods, to determine the presence and extent of VOCs in solution in the aquifer. 66 of the samples had detectable concentrations of VOCs. The Phase II water quality program focused on the potential source areas identified in Phase I. Maximum concentrations of VOC detected in groundwater at the potential source areas included: Wade Electric, 230 µg/L TCE and BMDL for PCE. Groundwater samples collected at Kirsch Company Plant 1 yielded a maximum of 19,200 µg/L TCE and 69 µg/L PCE.

Phase IIB

- Nine additional monitoring wells were installed to further define the extent of the contaminant plume and provide geologic data to a depth of approximately 250 feet.

- Four new soil borings were performed in areas identified as potential source areas to further characterize the areal extent of VOC distribution.

- Another round of groundwater sampling was conducted to monitor contaminant plume migration.

Results of the RI documented large plumes of TCE and PCE contaminated groundwater in at least two aquifers, as well as in soils of the two source areas. Levels of TCE and PCE exceeded state and federal standards in both the groundwater and soil.

IV. Remedial Actions

Remedy Selection

Following the completion of the RI/FS, the U.S. EPA issued a ROD in September 1991. The selected remedy consisted of the following:

- SVE of VOCs in the Kirsch and Wade Electric source area soils until state risk based cleanup levels are reached;
- Excavation of contaminated soils that cannot be treated with SVE;
- Restoration of groundwater to its beneficial use. This would be accomplished via extraction and treatment of groundwater using air stripping, with vapor phase granular activated carbon to be used to treat the off-gasses;
- Discharge of treated water to surface water (via the storm sewer) or to the municipal system;
- A minimum of a 30-year groundwater monitoring program to assure the effectiveness of RA and the quality of the municipal water supply;
- Reliance on the county well permitting program to ensure no wells are placed within the groundwater contaminant plume.

Implementation of Interim Response

In 1992 State of Michigan personnel collected a comprehensive round of groundwater samples from all known monitoring and production wells in the city. Analytical results from this sampling effort indicated that the plume of contamination in the deep aquifer was migrating toward the Oaklawn municipal well, which was one of the remaining uncontaminated city of Sturgis water production wells. Subsequent groundwater modeling conducted by the state provided further indication that the plume was migrating toward the city well.

With this new information in hand, the U.S. EPA and the MDEQ decided to move forward with an interim response, which would consist of one extraction well located in the till window. The extraction well would pump at a rate sufficient to halt migration of the plume toward the Oaklawn production well. Using Superfund dollars the U.S. EPA retained the services of an engineering firm to

design and install the interim response extraction well. As the design was nearing the 60 percent complete stage, Cooper Industries (Cooper), the parent company of Kirsch requested the opportunity to take over the interim response project. The U.S. EPA responded by issuing Cooper a UAO for completion of the interim response.

Cooper completed the design and began construction of the interim response in late summer/early fall of 1993. Construction was completed in May 1994 and has been operational since that time. Specific components of the interim response, which was later referred to as the extraction well number one or EW-1 system, include the extraction well capable of pumping at rates up to 3,000 gpm, one-half mile of conveyance pipe, and the treatment system which is located at the Kirsch Company Plant 1. The treatment system consists of a 70 foot tall, 12-foot diameter air stripping tower. Contaminated off-gasses are treated by two 20,000 pound granular activated carbon vessels. Treated groundwater is discharged to the city storm sewer, which in turn discharges to the Nye Drain and then to the Fawn River, St. Joseph River, and ultimately to Lake Michigan.

Decision to Move Forward as a Fund-Financed RD/RA

In early 1993 the U.S. EPA and the MDEQ entered into settlement negotiations with the PRP and Cooper Industries for takeover of the ROD remedies. After lengthy discussions the U.S. EPA chose to cease negotiations with Cooper and fund the RD/RA with the MDEQ as the lead entity.

During the fall of 1994, the MDEQ's consultants conducted a predesign investigation at the site to determine the exact nature and extent of soil contamination at the Kirsch and Wade source areas for the purpose of designing soil remediation systems. A deep aquifer hydrogeological investigation was also conducted to determine whether contamination exists further downgradient than the agencies had believed. Results of the deep aquifer investigation revealed that there was indeed groundwater contamination further downgradient and that additional investigation was warranted. After the predesign investigation was complete, the MDEQ's consultant began the engineering design for the SVE systems.

PRP Takeover of the RD/RA and Issuance of ROD Amendment

During much of 1996, the MDEQ negotiated a settlement with the PRP for their takeover of all activities at the site under the direction of the MDEQ. In late summer an agreement was reached and a Consent Decree (CD) and Statement of Work were lodged in federal court under the authority of Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). The CD was entered by the court on October 25, 1996.

Also during 1996, the U.S. EPA issued a ROD Amendment that altered the 1991 remedy for the site. Under the ROD Amendment, the goal of the groundwater remedy remained unchanged, which is to restore the aquifer to its beneficial use. The ROD Amendment changed groundwater and soil cleanup standards to comply with current state law, eliminated the Wade Electric source area from requiring SVE remediation, and eliminated the requirement of excavation of soils contaminated with polynuclear aromatic hydrocarbons (PAHs) due to changes in the state cleanup criteria.

Soil Vapor Extraction

Construction of the SVE system at the Kirsch source area began in December 1996, and was completed in March 1997.

The SVE work was completed in the spring of 2000. Cleanup verification sampling conducted immediately following system shutdown showed an area of contamination above cleanup criteria. The PRPs conducted additional cleanup verification sampling in the summer of 2001 and submitted a report to the MDEQ. The report advocated no further RA in the Kirsch source area, a conclusion that the MDEQ did not support. Subsequent discussions with Newell-Rubbermaid resulted in an agreement to install a groundwater extraction well immediately downgradient of the Kirsch source area to remove highly contaminated water in the shallow aquifer beneath the source area, rather than conduct additional SVE. Soil TCE concentrations are expected to decline at a gradual rate and will be monitored over time to ensure that they are actually reducing.

Installation of EW-2 Groundwater Extraction and Treatment System

In late 1997 and early 1998, the PRP conducted an investigation to determine if the interim extraction and treatment system was capturing and removing the entire groundwater contaminant plume and whether or not it could be designated the final groundwater remedy for the site. In the early fall of 1998, a report was submitted to the MDEQ detailing the results of the investigation. The report made it clear to the MDEQ that the capture zone for EW-1 was not large enough to capture the portion of the plume that existed at monitoring well W-44. Also, TCE concentrations at monitoring well W-44 had exhibited no clear reductions since installation of the well in 1994. In early 1999 the MDEQ determined that an additional groundwater extraction and treatment system was needed to fully capture the lower aquifer contaminant plume and protect a series of industrial pumping wells in the northwest part of Sturgis.

The design for the new EW-2 system called for the installation of an extraction well that would pump 2,000 gallons of contaminated water per minute. The water would be treated by a new 70-foot-tall, 10-foot-diameter air stripper. Contaminant laden off-gasses would be treated with two 13,000 pound vapor phase granular activated carbon units. The project was delayed due to

difficulties between the city of Sturgis and Newell-Rubbermaid regarding permitting of the discharge of treated effluent into the city's storm sewer and retention pond. These difficulties were resolved and the RD/RA continued under a revised schedule. Construction of the EW-2 groundwater extraction and treatment system was completed in early 2002, with full-time operation commencing on May 13, 2002.

Installation of EW-3

The SVE operations of 1997-2000 greatly reduced VOC concentrations in the Kirsch source area soil. However, cleanup verification sampling conducted in 2000 and 2001 disclosed an area just above the water table and below the SVE well points that contained VOCs above the cleanup standard. The PRP maintained that the water table had lowered and off-gassing of VOCs from the aquifer had contaminated the vadose zone immediately above the water table. Rather than embark on a protracted dispute resolution the parties decided to work in a collaborative manner. This effort resulted in the agreement to install a shallow aquifer extraction well immediately downgradient from the Kirsch source area. The logic being that if the aquifer is actually off-gassing VOCs to the vadose soils, then removal of the highly contaminated groundwater made good sense. Vadose zone soil contaminant levels would be monitored over time to ensure that the soils eventually comply with ROD mandated cleanup standards. The rate of reduction is expected to be gradual.

Construction of the shallow aquifer extraction well, designated as EW-3, began in August 2003 and was completed in November 2003. Full time operation began shortly thereafter, with discharge of water to the EW-1 treatment plant. Current operation of the groundwater extraction system is as follows: EW-1 1,100 gpm, EW-2 2,000 gpm, and EW-3 250 gpm.

V. Progress Since the Last Five-Year Review

Significant progress has been made on the Sturgis site since the last five-year review, including the completion of the SVE portion of the remedy, continued operation of the EW-1 groundwater extraction and treatment system, installation and full-time operation of the EW-2 groundwater extraction and treatment system, and the installation and operation of the EW-3 extraction well.

While there were no follow-up actions which impact protectiveness of the selected remedy identified in the previous five-year review report, there were two recommendations made. The first recommendation was to conduct additional hydrogeological characterization of the basal till/bedrock valley to the east and southeast of the center of the lower aquifer contaminant plume. Because of an ongoing focus on capturing the known groundwater plumes, this recommendation has not yet been implemented. The need for this evaluation is reiterated as part of this five-year review, and is included in the Issues and

Recommendations and Followup Actions sections of this report. Please see Sections VIII and IX of this report for further discussion of this proposed study.

An additional recommendation from the first five-year review was to review the long-term groundwater monitoring plan once the final groundwater remedy is in place and make modifications as appropriate. This has recently been done and modifications to the sampling frequency of some wells has been made, and additional groundwater monitoring wells were installed in December 2004.

Other site related activities undertaken since the last review include the installation of a second production well in Thurston Woods Park by the city of Sturgis, the installation of three new monitoring wells (W-51 and W-52 along White School Road) and W-53 between the Kirsch source area and Thurston Woods Park, the cessation of pumping at the industrial wells in the northeast portion of the city, and the installation of a stormwater retention basin on the west side of the city.

VI. Five-Year Review Process

Administrative Components

The PRP, Newell-Rubbermaid was notified of the start of the five-year review in mid-2004. The five-year review was led by Mr. Robert L. Franks, the MDEQ Project Manager for the site, and included Mr. John Esch, the MDEQ Project Geologist, and Mr. Pablo Valentin, the U.S. EPA Remedial Project Manager (RPM).

Community Notification and Involvement

Based upon prior community involvement, it was decided to publish a notice in the local newspaper that the five-year review was being conducted. The public notice was published on September 30, 2004, in the Sturgis Journal (please see Attachment 6). Neither the MDEQ nor the U.S. EPA received any responses from the public.

The completed five-year review will be placed in the information repository and a notice will be published in the Sturgis Journal notifying communities of the completion of the five-year review. It will also be found at the U.S. EPA's website at www.epa.gov/region5/superfund/fiveyear/fyr_index.html. Additionally, interested persons can follow site progress by reading the updated fact sheets found at the U.S. EPA's website www.epa.gov/superfund/sites/npl/mi.htm. Also, updated site information can be obtained through the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database found at the U.S. EPA's website.

Document Review

This five-year review consisted of a review of relevant documents including the RI/FS, ROD, ROD Amendment, semi-annual groundwater monitoring reports, and others as shown in Attachment 2.

Site Inspection

A site inspection was conducted on September 27, 2004. The purpose of the site inspection was to physically observe all aspects of the site, from site security to the integrity of monitoring well casings, to a review of the groundwater extraction and treatment operations. A summary of the site inspection is as follows:

Site Security: Site fencing was inspected at the Kirsch source area, the EW-1/EW-3 groundwater treatment plant, and the EW-2 groundwater treatment plant. In each case the fencing appeared to be intact and in good condition. Site security appears adequate for the site.

Remediation Equipment and Control Buildings: All equipment associated with the groundwater extraction and treatment systems (pumps, blowers, carbon vessels, stripping towers, etc.) appear to be in good condition and well maintained. The blower for the SVE system is inoperable. In the unlikely event that additional SVE is needed at the site a new blower will need to be procured.

Monitoring Wells: The vast majority of monitoring wells are in good condition, with intact protective casings or vaults and concrete pads. There were several wells in need of repair, due to physical damage to the well riser, deterioration of protective casings or to the concrete pad. These wells were repaired by a professional well drilling firm in December 2004.

Interviews

On September 27, 2004, an on-site interview was conducted with the operation and maintenance (O&M) manager, Mr. Mike Miller of Environmental Health and Safety Outsource Services. Mr. Miller has operated all of the remediation systems at this site since their construction.

Overall, Mr. Miller is pleased with the systems he operates and maintains in Sturgis. The systems are quite user friendly, and with the built in automation, much of the operations can be monitored and controlled remotely. If problems arise, logic built into the computer system will automatically call Mr. Miller to so notify him.

During the discussion Mr. Miller gave a general overview of his duties as site O&M manager. Mr. Miller stated that he is generally on-site three days per week.

Two visits per week are to do a visual and audio inspection of the systems to ensure that all components are operating normally. Once a week Mr. Miller will lubricate the systems, perform various documentation activities, and do visual inspection of the outfall. The National Pollutant Discharge Elimination System (NPDES) sampling is conducted once per month.

Mr. Miller stated that he conducts air sampling between the two carbon units at each treatment plant once per month. When his samples exhibit detectable concentrations of VOCs between the two carbon vessels, indicating saturation of carbon in the first unit, he will immediately order a change out of the first unit. Presently, the EW-1/EW-3 system has one carbon change out approximately every ten months. It is necessary to change out the carbon in the EW-2 system approximately three to four times per year.

He stated that influent VOC concentrations for the three extraction wells are as follows:

- EW-1 - 150 parts per billion (ppb) - 175 ppb total VOCs.
- EW-2 - 500 ppb - 600 ppb total VOCs.
- EW-3 - mid-200 ppb total VOCs.

Mr. Miller stated that the air strippers do a very good job removing VOCs from the groundwater, with effluent concentrations normally at undetectable levels. He stated that when effluent concentrations reach approximately 5 ppb, he schedules acid cleaning of the air stripper towers. The EW-1/EW-3 tower is acid cleaned every two years. The EW-2 tower is cleaned one to two times per year. Mr. Miller stated that it takes two semi-tankers of muriatic acid to clean one tower, and the process takes three to four days to complete. Spent acid is then neutralized with sodium hydroxide and discharged to the municipal wastewater treatment plant.

The only recent problem that has resulted in significant system downtime was during a storm last summer lightning struck the EW-1/EW-3 treatment plant. The lightning strike destroyed much of the plant's controls, and because they were ten years old, replacement parts could not be purchased. This resulted in the need to purchase all new controls for the EW-1/EW-3 treatment plant. A resulting positive impact is that the two treatment plants now have identical controls, which allows them to be operated in a much simpler and efficient fashion.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

Remedial Action Performance

The review of documents, applicable or relevant and appropriate requirements, risk assumptions, groundwater monitoring data, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD and ROD Amendment and as intended by their respective design documents. Soil contaminant concentrations have been greatly reduced by the SVE operations. Residual soil VOCs will likely leach to the shallow aquifer where they will be captured by EW-3. This hypothesis will need to be confirmed by future soil sampling.

Groundwater contaminant concentrations have been significantly reduced since system startup. As shown in Attachment 4, the mass of VOCs removed from the aquifers beneath the city of Sturgis now stands at just under 66,000 lbs. Water level data appear to suggest that the plumes in both the shallow and deep aquifers are hydraulically controlled by the extraction wells. Additional work may be necessary to verify complete chemical capture, particularly on the western, downgradient edge of the plume. For additional discussion on the chemical capture verification issue, please see "Chemical Capture of Deep Aquifer Plume" in section VIII below.

System Operations

Operating procedures appear to be adequate to maintain the effectiveness of the RAs. The operating procedures at this site have been in place for over ten years for the EW-1 system, and since its startup the system has consistently performed as intended. EW-2 has been operational for significantly less time than EW-1. Indications are that it is largely operating as designed, although some minor modifications to the pumping rates or system components may be necessary. EW-3 has operated for even less time than EW-2. Its effectiveness is yet to be determined, although early indications are that it is operating as designed. Additional monitoring wells were installed around EW-3 in December 2004. These enhancements to the groundwater monitoring system will allow a better evaluation of the effectiveness of EW-3.

Opportunities for Optimization

The only optimization issue to present itself during this five-year review is an operational issue. There has been an ongoing problem of calcium carbonate buildup inside the stripping towers and some of their associated piping. During

discussions with the O&M manager it became evident that an evaluation should be conducted to determine if an acceptable additive is available that would cost effectively reduce the amount of calcium carbonate buildup in the treatment systems. This would lead to a more efficient system, and more importantly, reduce the number of times the stripping towers would need to be acid cleaned. At this site, due to the extreme size of the stripping towers, it literally takes two semi-tanker trucks of acid to adequately clean the towers. If an additive could significantly reduce the frequency of tower cleanings, there is potential for realization of the additional benefit of a corresponding decrease in the potential for an accidental release of acid from the semi-tankers.

Early Indicators of Potential Issues

No trends in equipment breakdown were identified during this five-year review that would tend to indicate a significant problem or risk to remedy protectiveness. In actuality, system uptime at this site, especially when considering the size and volume of water being produced and treated, has been remarkable.

Implementation of Institutional Controls and Other Measures

The ROD for this site identified two measures to be taken. One is fencing of the site, which was done many years ago. The other is reliance upon the Branch-Hillsdale-St. Joseph Community Health Agency (health agency) well permitting program to prevent the installation of drinking water wells in and near the plume of groundwater contamination. A December 2004 discussion between the MDEQ project manager and staff of the health agency revealed an issue that will require followup action on the part of the MDEQ and the county health agency. According to staff of the health agency, they are aware that the plume of contamination exists, and that they would not knowingly approve a permit to install a drinking water well within the plume. The problem is, the state and county have never worked together to establish a map of specific locations where a drinking water well would not be allowed. This issue needs to be rectified in the very near future.

Question B: Are the exposure assumptions, toxicity data, cleanup levels and RA objectives (RAOs) used at the time of the remedy selection still valid?

Changes in Standards and TBCs

Cleanup criteria were originally established for this site in the 1991 ROD. Modifications to the remedy, as well as the cleanup criteria were made in the 1996 ROD Amendment, as discussed earlier in this report. No changes in standards have been made, either at the federal or state level, which would call into question the protectiveness of the remedy.

Changes in Exposure Pathways

There have been no changes in the land use of either the Kirsch or Wade source areas. The Kirsch source area remains a fenced, vacant lot in a mixed residential and commercial area. The Wade source area remains a vacant property that is partially used as a sporting goods retail outlet. With regard to the groundwater contaminant plume, no major changes in land use, which would require water withdrawals in the contaminated portion of the aquifer, have been identified. The plume exists largely within the city limits, which is an area served by municipal water. The portion of the plume that is outside of the city has not impacted any private water wells, and the land use in this part of the site remains largely agricultural.

No human health, ecological routes of exposure or other receptors were identified during this review that would call into question the protectiveness of the remedy. No new contaminants or contaminant sources have been identified, indicating that the original RI/FS and subsequent work at the site has adequately identified the nature and extent of contamination at this site. There have been no unanticipated toxic byproducts of the remedy identified since remedy implementation. Other than the issue discussed earlier in this report regarding the use of large quantities of acid to clean calcium carbonate buildup in the stripping tower, there have been no major issues with the remedy identified during this review.

No changes to the physical site conditions or the understanding of these conditions were identified during this review.

One positive change has been the cessation of pumping of the industrial wells in the northwest portion of the city. This will likely allow a more efficient removal of TCE contaminated groundwater by the EW-2 extraction system.

Changes in Toxicity and Other Contaminant Characteristics

The main contaminants of concern at the Sturgis site are TCE and PCE. These two compounds are some of the most commonly found contaminants at sites of environmental contamination. There have been no significant changes in the toxicity characteristics of either of these compounds since the last five-year review.

Changes in Risk Assessment Methods

No changes in standard risk assessment methods were identified during this five-year review. Changes to the MDEQ's standard methods of conducting risk assessment were the main reason for modifications to the cleanup criteria made in the 1996 ROD Amendment. No significant changes have occurred since that time.

Expected Progress Toward Meeting Remedial Action Objectives

With regard to the soil contamination at the Kirsch source area, the SVE system greatly reduced contaminant concentrations, except for an area immediately above the water table. This contamination is being addressed by the EW-3 system that has only been on-line for approximately one year. Evaluation of the effectiveness of EW-3 will be continuous and ongoing.

With regard to the progress of the groundwater cleanup, it is too early to make a definitive statement as to whether or not the remedy is on pace to achieve cleanup standards within a given timeframe. The EW-2 system has been functional for less than three years. Indications are that the combined extraction systems have created a zone of influence in the deep aquifer that has resulted in the western migration of a groundwater divide, such that the identified contaminant plume is now entirely on the eastern side of the divide. Groundwater flow on the eastern side of the groundwater divide is toward the extraction wells. Evaluation of the effectiveness of the systems in achieving chemical capture, particularly at the downgradient edges of the plume in the deep aquifer is continuous and ongoing. If modifications to the systems are necessary to achieve capture, and ultimately cleanup, they will be made. For additional discussion on this topic, please see "Chemical Capture of Deep Aquifer Plume" in section VIII below.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information, such as ecological impacts, unforeseen weather events or land use changes have been identified as part of this five-year review that would call into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed, the site inspection, and the interview, the remedy appears to be functioning as intended by the ROD, as modified by the ROD Amendment. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Soil contaminant levels have been greatly reduced, and additional remedial actions will ensure that residual soil contamination will be appropriately removed. The groundwater remedy appears to be functioning as intended. There have been no changes in the toxicity factors for the contaminants of concern. There have been no changes in the risk assessment methodology since issuance of the ROD Amendment. There is no other information that calls into question the protectiveness of the remedy, with the potential exception of a partial lack of complete chemical capture. This issue, if it truly exists, and nothing is done to address it, might affect the long-term protectiveness of the remedy. However, the issue will be

explored, and if there is a lack of chemical capture, the MDEQ will require an increase in pumping rates such that chemical capture will be complete.

VIII. Issues

While there were no major issues identified during the five-year review that would call into question the protectiveness of the remedy, there are site issues identified that warrant further evaluation and action.

Chemical Capture of Deep Aquifer Plume

With regard to the progress of the groundwater cleanup, it is too early to make a definitive statement as to whether or not the remedy is on pace to achieve cleanup standards within a given timeframe. The EW-2 system has been functional for less than three years. In evaluating the performance of a groundwater extraction system, one must evaluate the performance from both a hydraulic and chemical perspective.

Indications are that the combined extraction systems have created a zone of influence in the deep aquifer that has resulted in the western migration of a groundwater divide, such that the identified contaminant plume is now entirely on the eastern side of the divide. The groundwater flow on the eastern side of the groundwater divide is toward the extraction wells. This data suggests that the plume is captured from a hydraulic perspective.

To determine if chemical capture has been achieved, an analysis of groundwater contaminant concentrations over time is conducted. If contaminant concentrations have consistently declined at specific monitoring points, and hydraulic capture is present, a conclusion can be made that chemical capture has been achieved.

Evaluation of the effectiveness of the Sturgis groundwater extraction systems in achieving chemical capture, particularly at the western, downgradient edges of the plume in the deep aquifer is continuous and ongoing. The furthest downgradient contaminated monitoring well, W-44, was installed in 1995. At that time TCE concentrations in W-44 were 216 ppb. Since that time TCE concentrations have fluctuated between a low of 150 ppb in 2000 to a high of 276 ppb in 1996. Since startup of the EW-2 extraction well, monitoring well W-44 has been sampled five times, semi-annually. These samples show TCE concentrations of 171 ppb, 170 ppb, 181 ppb, 201 ppb, and 210 ppb. The four semi-annual samples collected from W-44 immediately prior to the startup of EW-2 exhibited TCE concentrations of 171 ppb, 161 ppb, 181 ppb, and 151 ppb.

The groundwater analytical data clearly demonstrate that in the approximately three years of EW-2 operation, there has been no discernable impact on TCE concentrations in monitoring well W-44. At the same time, water level data demonstrate that since startup of EW-2, there has been an increase in the size of

the capture zone in the deep aquifer, such that the deep aquifer contaminant plume is within this capture zone.

Eastern Basal Till/Bedrock Valley

An east/west trending valley in the basal till/bedrock exists in the city of Sturgis. It is known that groundwater contamination in the deep aquifer resides primarily at the bottom twenty to thirty feet of the bedrock valley. Hydrogeologic characterization of the western portion of the bedrock valley, which is the direction of groundwater flow in the deep aquifer, has been at least partially conducted. However, the eastern portion of the valley, east of the EW-1 extraction well has not been investigated at all. The concern is that if there had been historical dense non-aqueous phase liquid (DNAPL) present at this site there could easily have been migration of the DNAPL to the east, against the regional groundwater flow, if the base of the basal till/bedrock valley slopes to the east. While there has never been DNAPL identified at the Sturgis site, the U.S. EPA guidance clearly states that if groundwater concentrations of a given compound exceed one percent of its solubility in water, then DNAPL is likely. In the case of TCE, one percent of its solubility is 15,000 ppb. The groundwater TCE concentrations in excess of 15,000 ppb have historically been detected at this site, suggesting the likely presence of DNAPL.

Western Basal Till/Bedrock Valley

As discussed above, the western portion of the bedrock valley is at least partially characterized, although its location downgradient at White School Road is unknown. Residences on White School Road are the nearest downgradient potential receptors, as they rely upon private wells for their water supply. Also, there are two deep aquifer monitoring wells, W-51 and W-52 that are located on White School Road. Neither of these wells is included in the long-term groundwater monitoring network.

Ross Labs Monitoring and Production Wells/Other Monitoring Points

Seven monitoring wells (three of which are deep aquifer wells) and five deep aquifer production wells belonging to Ross Labs exist in proximity to the deep aquifer groundwater contaminant plume. None of these wells are sampled as part of the long-term groundwater monitoring network, nor are their static water levels collected for capture zone verification of the EW-1 and EW-2 systems.

Other deep aquifer wells, one identified as the "fire well" and the other as the unused city production well PW-3 (also known as the Broadus Well), are well placed to potentially be sampled or utilized for water level measurement, yet neither of them is utilized at all for purposes of the Superfund remediation.

Calcium Carbonate and its Treatment in EW-1 and EW-2 Stripping Towers

As discussed previously, there is an existing issue related to calcium carbonate buildup on the air strippers and some associated piping at this site. The issue is not so much that the calcium carbonate builds up in the stripping towers, but the potential risk associated with cleaning the towers to remove the buildup. Each tower cleaning requires the use of two semi-tankers of muriatic acid. Both of the towers are located within the city limits, with the EW-1 tower located in a residential area. Although precautions are taken while cleaning the towers, the sheer volume of a hazardous substance like muriatic acid certainly contains some inherent risks, primarily associated with the potential for a large spill.

Mapping of Drinking Water Well Prohibition Area

The ROD for the Sturgis site relies partly upon the county well permitting program to prevent exposure to the groundwater contaminant plume. While the county is aware of the existence of the plume of contamination, and would not knowingly permit the installation of a drinking water well within the plume, they do not have a map of specific geographic locations that should be prohibited from well installation. MDEQ staff and the county health agency need to work together to establish a map that would then be consulted when the health agency receives applications for a well permit.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions for the six issues identified in section VIII are identified below.

Chemical Capture of Deep Aquifer Plume

TCE concentrations at W-44 have not gone down as anticipated with the startup of the EW-2 system. The MDEQ needs to determine if modifications or additions to the groundwater pumping systems are necessary to begin to lower the TCE levels at the W-44 monitoring point. The MDEQ needs to request a pumping system evaluation by Newell-Rubbermaid, to be completed by the end of 2005, after which the MDEQ will determine if changes to the extraction systems are necessary.

Eastern Basal Till/Bedrock Valley

The valley to the east of EW-1 needs to be evaluated. Mindful of the potential high costs associated with a full blown drilling program, when each borehole will be between 250 and 300 feet deep, the MDEQ and Newell-Rubbermaid should work together to arrive at a mutually acceptable approach to resolving this issue. The MDEQ and Newell-Rubbermaid should also investigate the possibility of extending the depth of the city's Lakeview production well, which may be located

in the valley. There has been some discussion of the city of Sturgis abandoning the use of this production well, in favor of their other three municipal wells, so its potential use as a data point in this investigation should be determined. This evaluation should be conducted by Newell-Rubbermaid, and be completed by June 2006.

Western Basal Till/Bedrock Valley

The MDEQ and Newell-Rubbermaid need to evaluate adding residential well sampling and sampling of W-51 and W-52 as part of the long-term groundwater monitoring program. The MDEQ needs to make a final determination on this issue by October 1, 2005.

Ross Labs Monitoring and Production Wells/Other Monitoring Points

The Ross Labs wells, the fire well, and PW-3 are potentially too valuable of a resource to ignore. The MDEQ should work with Newell-Rubbermaid, Ross Labs, and the city of Sturgis to secure access to these wells and, at a minimum, collect static water levels on those in the deep aquifer. An evaluation and determination on the potential usefulness of water quality sampling of some or all of these Ross wells should also be undertaken, and if needed, added to the long-term groundwater monitoring network. The MDEQ needs to make a final determination on this issue by October 1, 2005.

Calcium Carbonate and its Treatment in EW-1 and EW-2 Stripping Towers

The potential risk associated with muriatic acid spills during cleaning of the stripping towers warrants the investigation and consideration of the use of additives in the influent at the two treatment plants. Newell-Rubbermaid should enter into discussions with the MDEQ Water Bureau to determine which available additives would be acceptable to discharge under the current NPDES permit, and then give strong consideration to modifying their operations to include a continuous feed additive that would prevent calcium carbonate buildup in the stripping towers. Newell-Rubbermaid should complete this evaluation by the end of 2005.

Mapping of Drinking Water Well Prohibition Area

The MDEQ and county health agency need to work together to ensure that no residential drinking water wells are installed into the groundwater contaminant plume associated with this Superfund site. The MDEQ needs to provide the county with a map of geographic locations that could be consulted by health agency staff when they receive applications for well permits for locations in and around the city of Sturgis. It should be recognized that the map may need periodic updating as more information on contaminant plume dimensions is gained over time. This task should be completed by the MDEQ by the end of 2005.

X. Protectiveness Statement(s)

The remedy is protective in the short term because actions to date prevent current exposures. In the long-term, the site and its remedies are expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, which is expected to require 20 to 30 years to achieve. In the interim, measures will be taken to prevent unacceptable exposures by providing local authorities with maps to better discern geographic locations for which the installation of residential drinking water wells would be forbidden.

The RAs undertaken at the Sturgis Municipal Wells site have been consistent with those chosen in the ROD and ROD Amendment. The SVE at the Kirsch source area has substantially achieved remedial objectives. Subsequent actions have been undertaken to address the residual contamination existing immediately above the water table. Once contaminants are removed from this area, RA objectives will then be met for the soils portion of this site.

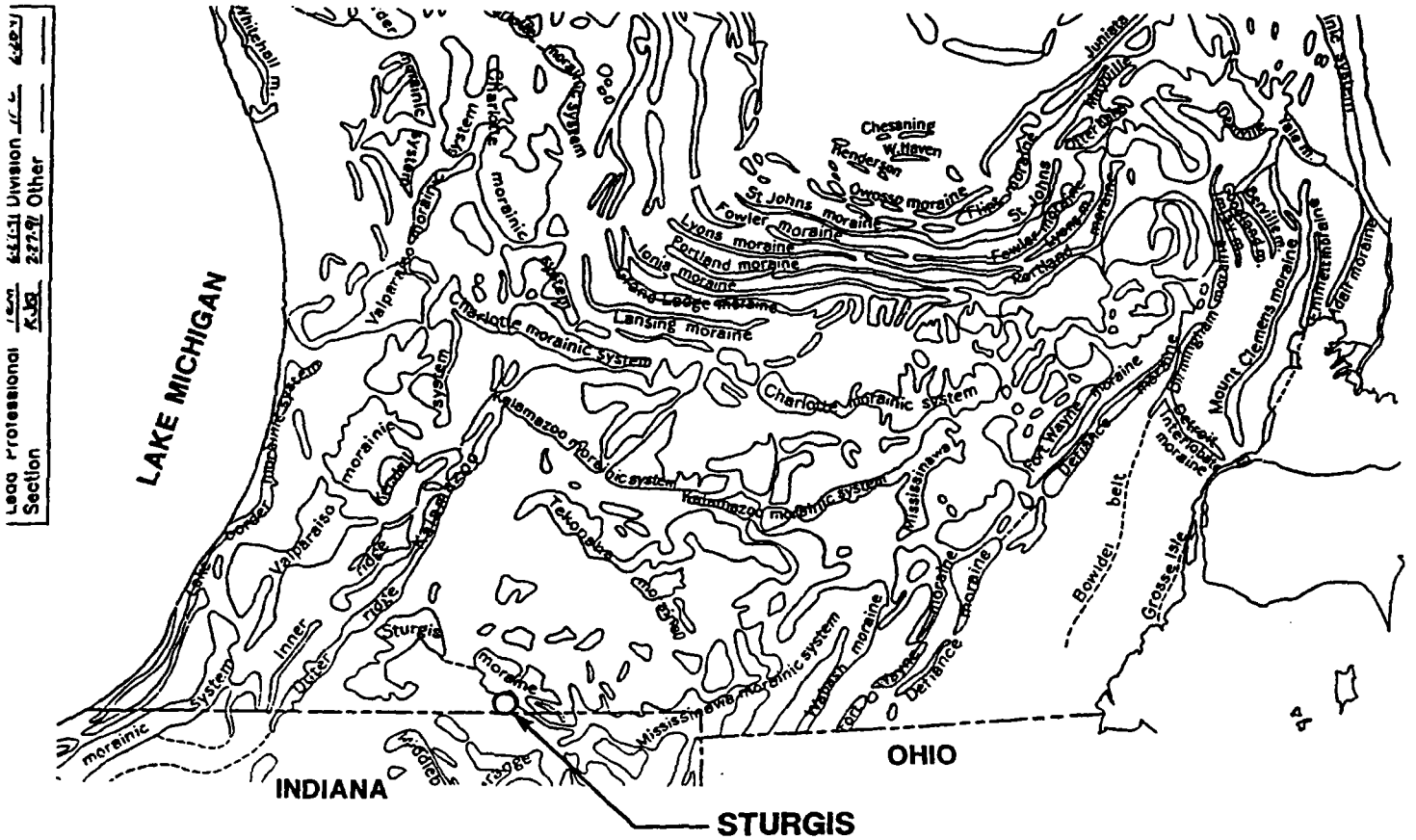
The groundwater RAs undertaken at the site have created a zone of influence in the deep aquifer that has resulted in the western migration of a groundwater divide, such that the identified contaminant plume is now entirely on the eastern side of the divide. Groundwater flow on the eastern side of the groundwater divide is toward the extraction wells. Chemical capture may be complete; but if not, will be complete with minor modifications to the pumping strategy or system components.

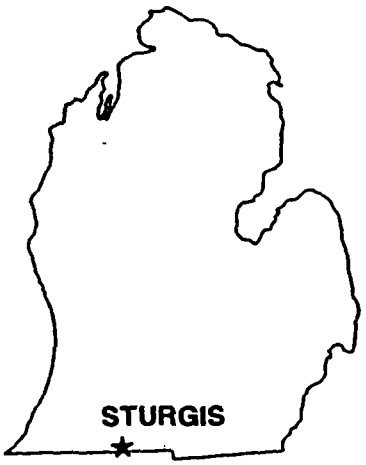
XI. Next Review

Because hazardous substances remain at the site above levels that allow for unrestricted use and unlimited exposure, another review will be conducted in five years. The next review will be completed by December 31, 2009.

Attachment 1

Site Maps





NOTES

1. BASE MAP DEVELOPED FROM HYDROGEOLOGIC ATLAS OF MICHIGAN, GLACIAL AND SURFICIAL GEOLOGY SOUTHERN PENINSULA, DATED 1981.
2. THE CITY OF STURGIS IS LOCATED APPROXIMATELY.

north

SCALE: 1" = 3.27 mi. (APPROX.)

WARZYN	RECESSIONAL MORAINES OF THE SOUTHERN HALF OF THE MICHIGAN LOWER PENINSULA	Drawn JC	Checked TEM	App'd T. Mathia
	REMEDIAL INVESTIGATION/ FEASIBILITY STUDY STURGIS WELL FIELD STURGIS, MICHIGAN	Revisions		Date 3-6-91
				12686 A8

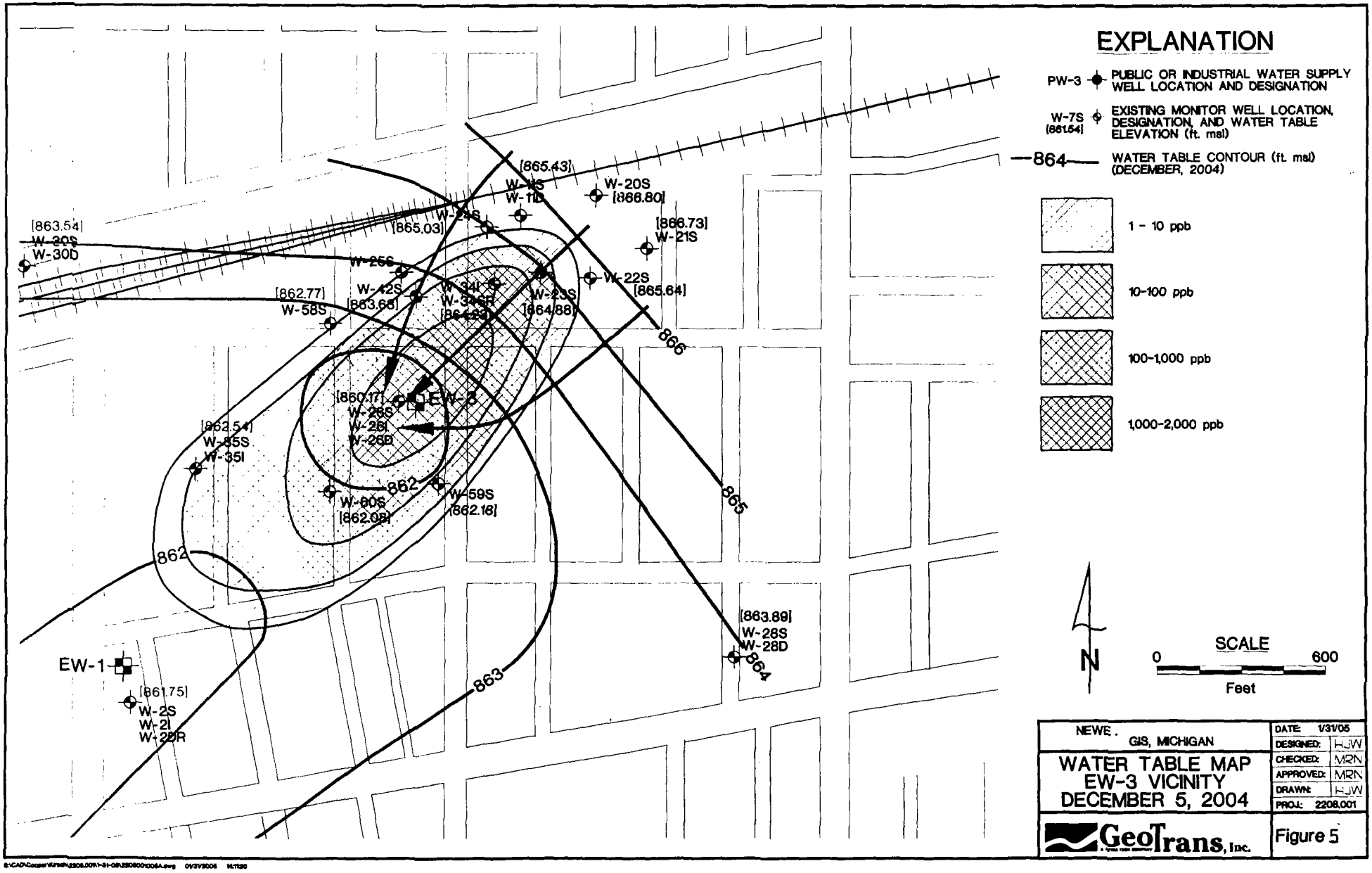

EXPLANATION
PW-3 PUBLIC OR INDUSTRIAL WATER SUPPLY WELL LOCATION AND DESIGNATION
W-7S [861.54] EXISTING MONITOR WELL LOCATION, DESIGNATION, AND WATER TABLE ELEVATION (ft. msl)
864 WATER TABLE CONTOUR (ft. msl) (DECEMBER, 2004)
1 - 10 ppb
10-100 ppb
100-1,000 ppb
1,000-2,000 ppb
[865.43]
W-19S
W-11D
W-20S
[866.80]
[865.03]
W-24S
[866.73]
W-21S
[863.54]
W-30S
W-30D
W-25S
W-42S
[863.65]
W-34I
W-34DR
[864.29]
W-23S
[864.88]
W-22S
[865.64]
[862.77]
W-58S
866
[860.17]
EW-3
W-26S
W-26I
W-26D
[862.54]
W-35S
W-35I
862
W-60S
[862.08]
W-59S
[862.18]
865
862
[863.89]
W-28S
W-28D
864
EW-1
[861.75]
W-2S
W-2I
W-2DR
863
N
SCALE
0
600
Feet
NEWE . GIS, MICHIGAN
WATER TABLE MAP
EW-3 VICINITY
DECEMBER 5, 2004
DATE: 1/31/05
DESIGNED: HJW
CHECKED: MRN
APPROVED: MRN
DRAWN: HJW
PROJ.: 2208.001
GeoTrans, Inc.
Figure 5

Figure 5

EXPLANATION

PW-3 — PUBLIC OR INDUSTRIAL WATER SUPPLY WELL LOCATION AND DESIGNATION

W-78 [861.54] — EXISTING MONITOR WELL LOCATION, DESIGNATION, AND WATER TABLE ELEVATION (ft. msl)

—864— WATER TABLE CONTOUR (ft. msl) CONTOUR INTERVAL 2.0ft.

FLOW DIRECTION

N

SCALE

0 2400

Feet

NEWELL RUBBERMAID INC. STURGIS, MICHIGAN	DATE: 5/14/04
	DESIGNED: HJW
WATER TABLE MAP UPPER AQUIFER (April 27, 2004)	CHECKED: MRN
	APPROVED: MRN
	DRAWN: HJW
	PROJ.: 2206.001
GeoTrans, Inc. A TETRA TECH COMPANY	Figure 1

BAGNO\cogo\Wo\M2206.001\2-10-04\2206001001A.dwg 05/14/2004 09:05:07

EXPLANATION

PW-3 — PUBLIC OR INDUSTRIAL WATER SUPPLY WELL LOCATION AND DESIGNATION

W-6D [860.09] — EXISTING MONITOR WELL LOCATION, DESIGNATION, AND POTENTIOMETRIC ELEVATION (ft. msl)

862 — POTENTIOMETRIC SURFACE CONTOUR (ft. msl) CONTOUR INTERVAL 1.0ft.

FLOW DIRECTION

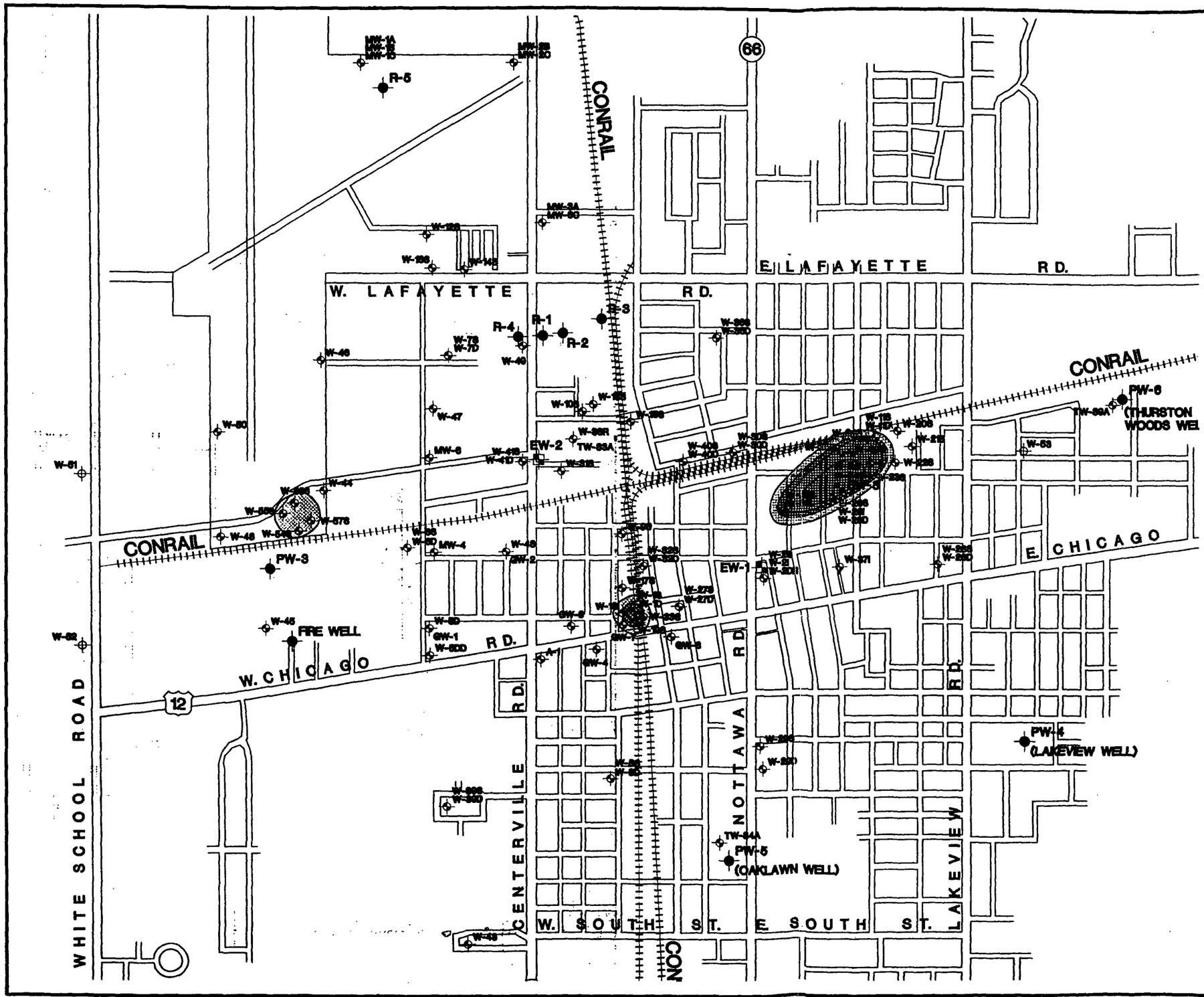
N

SCALE

0 2400

Feet

NEWELL RUBBERMAID INC. STURGIS, MICHIGAN	DATE: 5/14/04
	DESIGNED: HJW
POTENTIOMETRIC SURFACE LOWER AQUIFER (April 27, 2004)	CHECKED: MRN
	APPROVED: MRN
	DRAWN: HJW
	PROJ.: 2206.001
GeoTrans, Inc. A TETRA TECH COMPANY	Figure 2



NEWELL RUBBERMAID INC. STURGIS, MICHIGAN	DATE: 6/9/04 DESIGNED: HJW CHECKED: MRN APPROVED: MRN DRAWN: HJW PROJ.: 2206.001
CONTAMINANT PLUME UPPER AQUIFER (April, 2004)	
GeoTrans, Inc.	Figure 3

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SCALE

0 2400

Feet

NEWELL RUBBERMAID INC. STURGIS, MICHIGAN	DATE: 6/9/04 DESIGNED: HJW CHECKED: MRN APPROVED: MRN DRAWN: HJW PROJ.: 2206.001
CONTAMINANT PLUME LOWER AQUIFER (April, 2004)	
GeoTrans, Inc. A TETRA TECH COMPANY	Figure 4

Attachment 2

List of Documents Reviewed

- Remedial Investigation Report, March 1991
- Feasibility Study, May 1991
- Record of Decision, September 1991
- Unilateral Administrative Order, October 1992
- Record of Decision Amendment, September 1996
- Consent Decree, October 1996
- Semi-Annual Monitoring Reports

Attachment 3

First 2004 Semi-Annual Monitoring Report

GeoTrans, Inc.
A TETRA TECH COMPANY

175 N. Corporate Drive
Suite 100
Brookfield, WI 53045

www.geotransinc.com

262-792-1282 FAX 262-792-1310

FIRST 2004 SEMIANNUAL SAMPLING EVENT GROUNDWATER MONITORING PROGRAM STURGIS MUNICIPAL WELL FIELD NPL SITE STURGIS, MICHIGAN

June 9, 2004

Prepared For:

Newell Rubbermaid, Inc.
2707 Butterfield Road, Suite 100
Oak Brook, Illinois 60523

Prepared By:

GeoTrans, Inc.
Brookfield Lakes Corporate Center XII
175 Corporate Drive, Suite 100
Brookfield, Wisconsin 53045

Project # P-140

TABLE OF CONTENTS

FIGURES

TABLES

TABLE OF CONTENTS (CONT'D)

CHARTS

APPENDICES

1.0 INTRODUCTION

This report presents the results of the first 2004 semiannual groundwater monitoring event performed by Newell Rubbermaid, Inc. for the Sturgis Municipal Well field NPL site in Sturgis, Michigan. Groundwater sampling and analysis activities were conducted in accordance with the approved July, 2003 Monitoring Plan included with Supplemental Groundwater Extraction/Treatment System (EW-3) Final Design Submittal.

2.0 FIELD ACTIVITIES

Newell Rubbermaid, Inc. conducts routine groundwater monitoring at the Sturgis site on a semiannual basis. The purpose of these activities is to evaluate the concentrations of volatile organic compounds (VOCs) with respect to time and to evaluate the performance of the groundwater extraction/treatment system. In addition, samples collected from lower aquifer wells were also analyzed for selected inorganic and metals parameters as part of the first 2004 semiannual sampling program.

The first 2004 semiannual groundwater monitoring event was performed by GeoTrans on April 27-29, 2004. The first 2004 semiannual sampling event consisted of the following:

- Measurement of static water levels at 61 monitoring locations,
- Collection of groundwater samples at 22 monitoring locations,
- Analysis of 22 groundwater samples and three quality assurance/quality control (QA/QC) samples for VOCs, and
- Data analyses and presentation.

Standard U. S. Environmental Protection Agency (USEPA) and MDEQ monitor well sampling procedures and protocols were followed. Groundwater monitoring locations are presented in Figure 1.

Prior to evacuating water from each well, the depth to groundwater was measured within each monitor well on April 27, 2004 in order to determine groundwater elevations for the development of groundwater elevation contour maps and to delineate groundwater flow directions. Most of the monitor wells were then sampled by using low-flow sampling procedures. Low-flow purging and sampling was conducted using MicroPurge bladder pumps

manufactured by QED Environmental Systems, Inc. dedicated to each monitor well. Groundwater samples were collected through the dedicated tubing when field measurements for temperature, pH, and specific conductance had stabilized. Wells W-34SR, W-35I and W-54S do not have dedicated low-flow sampling equipment and were purged with a Grundfos pump and then sampled with dedicated or disposable bailer.

Samples for laboratory analysis were collected in laboratory-prepared bottles containing an appropriate amount of preservative. Samples were properly labeled and packaged for shipment to the analytical laboratory in shuttles containing ice packs. GeoTrans' standard chain of custody protocol was strictly adhered to during all phases of sample collection, transport, and delivery to the laboratory.

During the sampling round one trip blank sample accompanied the samples during groundwater sampling activities to verify that the samples and/or sample containers were not contaminated in transit to and/or from the laboratory. In addition, matrix spike/matrix spike duplicate (MS/MSD) analyses were performed on two samples to evaluate possible matrix interferences and the laboratory's ability to recover the constituent. No equipment blank samples were prepared because dedicated sampling equipment was used.

3.0 DATA PRESENTATION AND ANALYSIS

This section presents an analysis of groundwater flow at the site and summarizes the chemistry data for the groundwater samples collected for the first 2004 semiannual sampling event. A comparison of current site groundwater quality to historical site groundwater quality is also presented.

3.1 Groundwater Flow Data

As previously mentioned, the depth from the top-of-well casing to the groundwater surface was measured in the field prior to sampling. The static groundwater levels measured in the field were converted to groundwater elevations reported as feet above mean sea level based upon surveyed measurement reference point elevations. These groundwater elevations are presented in Table 1. A water table map (Figure 1) and a potentiometric surface map (Figure 2) were generated from water level data collected on April 27, 2004. Historical water level trends are presented in Charts 1-3 for upper aquifer wells and Charts 4-6 for lower aquifer wells.

Figure 1 illustrates the groundwater surface at the water table. This water table map was generated utilizing water level data collected from 30 wells in the upper aquifer. Figure 1 indicates that the dominating effect on groundwater flow is the window in the till separating the upper and lower aquifers. The window occurs in the vicinity of the extraction well EW-1. The pumping from the lower aquifer accentuates the flow through the till window. The depression in the water table above the till window is elongated toward the northeast as a result of groundwater extraction from the new upper aquifer well, EW-3. The water level data indicates that EW-3 provides capture of the plume extending from the former Kirsch source area. Groundwater flow in the vicinity of the inactive City of Sturgis infiltration basin is toward the southwest due to a groundwater mound that occurs between the infiltration basin and the EW-1 extraction well.

Figure 2 illustrates the groundwater surface in the lower aquifer beneath the site. This potentiometric surface map was generated utilizing water level data collected from 27 wells monitoring the lower aquifer. Figure 2 indicates that the dominating factors controlling flow in the lower aquifer during this time period were pumping from extraction wells EW-2 and EW-1 and Sturgis municipal well PW-5.

The hydraulic control of the EW-1 and EW-2 pumping centers extends approximately 3,600 feet west of EW-2.

3.2 Groundwater Chemistry Data

Field water quality parameters (temperature, pH, and specific conductance) are presented on the field forms in Appendix A. Groundwater samples collected during the sampling round were analyzed by Severn Trent Laboratories (STL) of University Park, Illinois for VOCs by USEPA Method 8260, (Appendix B). The VOC analytical results for the groundwater samples collected for the first 2004 semiannual sampling event are presented in Table 2 and summarized in Figures 3 and 4. Historical analytical data for each monitoring location are presented in Table 3. Time-concentration plots are presented in Charts 7-8 for selected upper aquifer wells and Charts 9-10 for selected lower aquifer wells. A summary evaluation of the VOC concentrations for each of the aquifer zones is presented below.

3.2.1 Upper Aquifer

A total of ten monitor wells were to be sampled in the upper aquifer during the first 2004 semiannual sampling event (Wells W-1S, W-11S, W-19S, W-23S, W-26S, W-26I, W-34SR, W-35I, W-42S and W-54S). Wells W-11S, W-23S, W-26S, and W-42S could not be sampled because of insufficient water. The dry wells appeared to be the combined effect of seasonally low water levels and pumping from EW-3. EW-3 was shut down for a day to see if the water level would recover enough for sample collection but it did not.

Wells W-1S and W-19S are located at or downgradient of the Wade Electric source area. The concentration of total chlorinated VOCs decreased approximately 15 % in well W-1S and 37% in well W-19S compared to the previous (October, 2003) sampling event (Table 3, Chart 8).

Wells W-11S, W-23S, W-26I, W-26S, W-34SR, W-35I and W-42S are located at or downgradient of the Kirsch Plant No. 1 source area. Only W-26I, W-34SR and W-35I could be sampled. The concentration of total chlorinated VOCs in well W-34SR was 237 ug/L which is approximately 97% less than the last time the well was sampled 16 years ago in 1988. The concentration in W-35I doubled from 11 to 21 ug/L. W-26I had a total chlorinated VOC concentration of 1.2 ug/L. It does not appear that W-26I had ever been sampled before. An isoconcentration map of total chlorinated VOCs for the upper aquifer is presented in Figure 3.

Well W-54S is located downgradient of the inactive City of Sturgis infiltration basin. This well was installed and sampled as part of an agreement between Newell Rubbermaid and the City of Sturgis. Trichloroethene was detected at 4.4 ug/L which is about one half the concentration detected in the previous sampling event in October, 2003.

3.2.2 Lower Aquifer

A total of 16 monitor wells were sampled in the lower aquifer during the second 2003 semiannual sampling event (W-2DR, W-5DD, W-26D, W-27D, W-32D, W-40D, W-41D, W-44, W-45, W-46, W-47, W-48, W-49, W-50, W-53, and TW-84A). Chlorinated VOCs were not detected at concentrations above the reporting limit (RL) in groundwater sampled from nine of these wells (W-5DD, W-26D, W-40D, W-45, W-46, W-48, W-50, W-53, and TW-84A). Total VOC concentrations in well W-27D had a low level detection but is below the groundwater standard. Total VOCs decreased by approximately 25 % in wells W-2DR and W-47 and 50% in wells W-32D and W-49. Total VOCs remained about the same in well W-41D and increased by approximately 11 % in well W-44. An isoconcentration map of total chlorinated VOCs for the lower aquifer is presented in Figure 4.

Groundwater monitoring results for the first 2004 semiannual sampling event indicate a continued general reduction in contaminant concentrations in the chlorinated VOC plumes in the upper and lower aquifers. The performance of the EW-1, EW-2 and EW-3 extraction/treatment systems are graphically presented in Charts 11, 12 and 13, respectively. The charts indicate approximately 59,586 pounds of TCE have been removed by EW-1 since system start up in 1994; 4,860 pounds of TCE have been removed by EW-2 since system start up two years ago; and 485 pounds of TCE have been removed by EW-3 since system start up in October 2003. The total pounds of TCE removed by the combined system is 64, 931 (Chart 14).

3.2.3 QA/QC

The trip blank sample contained 27 ug/L of methylene chloride which was also detected in 10 of the groundwater samples. All of the methylene chloride detections are considered lab related.

All LCS/LCD (Laboratory Control Samples/Duplicate) had all five controlled spike recoveries and RDP values within the in-house generated QC limit. MS/MSD analyses were performed on sample W-45. The MS and MSD samples had all controlled spike recoveries within the in-house QC limits. All of the volatile samples had surrogate recoveries within the in-house generated QC limit.

FIGURES

EXPLANATION

PW-3 — PUBLIC OR INDUSTRIAL WATER SUPPLY WELL LOCATION AND DESIGNATION

W-7S [861.54] — EXISTING MONITOR WELL LOCATION, DESIGNATION, AND WATER TABLE ELEVATION (ft. msl)

—864— WATER TABLE CONTOUR (ft. msl) CONTOUR INTERVAL 2.0ft.

FLOW DIRECTION

N

SCALE

0 2400

Feet

W. LAFAYETTE RD.

E. LAFAYETTE RD.

W. CHICAGO RD.

E. CHICAGO

W. SOUTH ST.

E. SOUTH ST.

CONRAIL

WHITE SCHOOL ROAD

CENTERVILLE RD.

NOTTAWA RD.

LAKEVIEW RD.

CONRAIL

PW-3

PW-4 (LAKEVIEW WELL)

PW-5 (OAKLAWN WELL)

PW-6 (THURSTON WOODS WE

FIRE WELL

R-1 R-2 R-3 R-4 R-5

EW-1 EW-2 EW-3

MW-1A MW-1B MW-1C MW-2B MW-2C MW-3A MW-3C MW-4 MW-5 MW-6

TW-84A TW-88A

GW-1 GW-2 GW-3 GW-4 GW-5 GW-6

A-1

W-7D W-7S W-22D W-23D W-24 W-25D W-26D W-27D W-28D W-29D W-30D W-31D W-32D W-33D W-34D W-35D W-36D W-37 W-38D W-39D W-40D W-41D W-42D W-43 W-44 W-45 W-46 W-47 W-48 W-49 W-50 W-51 W-52 W-53 W-54 W-55 W-56 W-57 W-58 W-59 W-60 W-61 W-62 W-63 W-64 W-65 W-66 W-67 W-68 W-69 W-70 W-71 W-72 W-73 W-74 W-75 W-76 W-77 W-78 W-79 W-80 W-81 W-82 W-83 W-84 W-85 W-86 W-87 W-88 W-89 W-90 W-91 W-92 W-93 W-94 W-95 W-96 W-97 W-98 W-99 W-100 W-101 W-102 W-103 W-104 W-105 W-106 W-107 W-108 W-109 W-110 W-111 W-112 W-113 W-114 W-115 W-116 W-117 W-118 W-119 W-120 W-121 W-122 W-123 W-124 W-125 W-126 W-127 W-128 W-129 W-130 W-131 W-132 W-133 W-134 W-135 W-136 W-137 W-138 W-139 W-140 W-141 W-142 W-143 W-144 W-145 W-146 W-147 W-148 W-149 W-150 W-151 W-152 W-153 W-154 W-155 W-156 W-157 W-158 W-159 W-160 W-161 W-162 W-163 W-164 W-165 W-166 W-167 W-168 W-169 W-170 W-171 W-172 W-173 W-174 W-175 W-176 W-177 W-178 W-179 W-180 W-181 W-182 W-183 W-184 W-185 W-186 W-187 W-188 W-189 W-190 W-191 W-192 W-193 W-194 W-195 W-196 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NEWELL RUBBERMAID INC. STURGIS, MICHIGAN	DATE: 5/14/04
	DESIGNED: HJW
WATER TABLE MAP UPPER AQUIFER (April 27, 2004)	CHECKED: MRN
	APPROVED: MRN
	DRAWN: HJW
	PROJ.: 2208.001
GeoTrans, Inc. A TETRA TECH COMPANY	Figure 1

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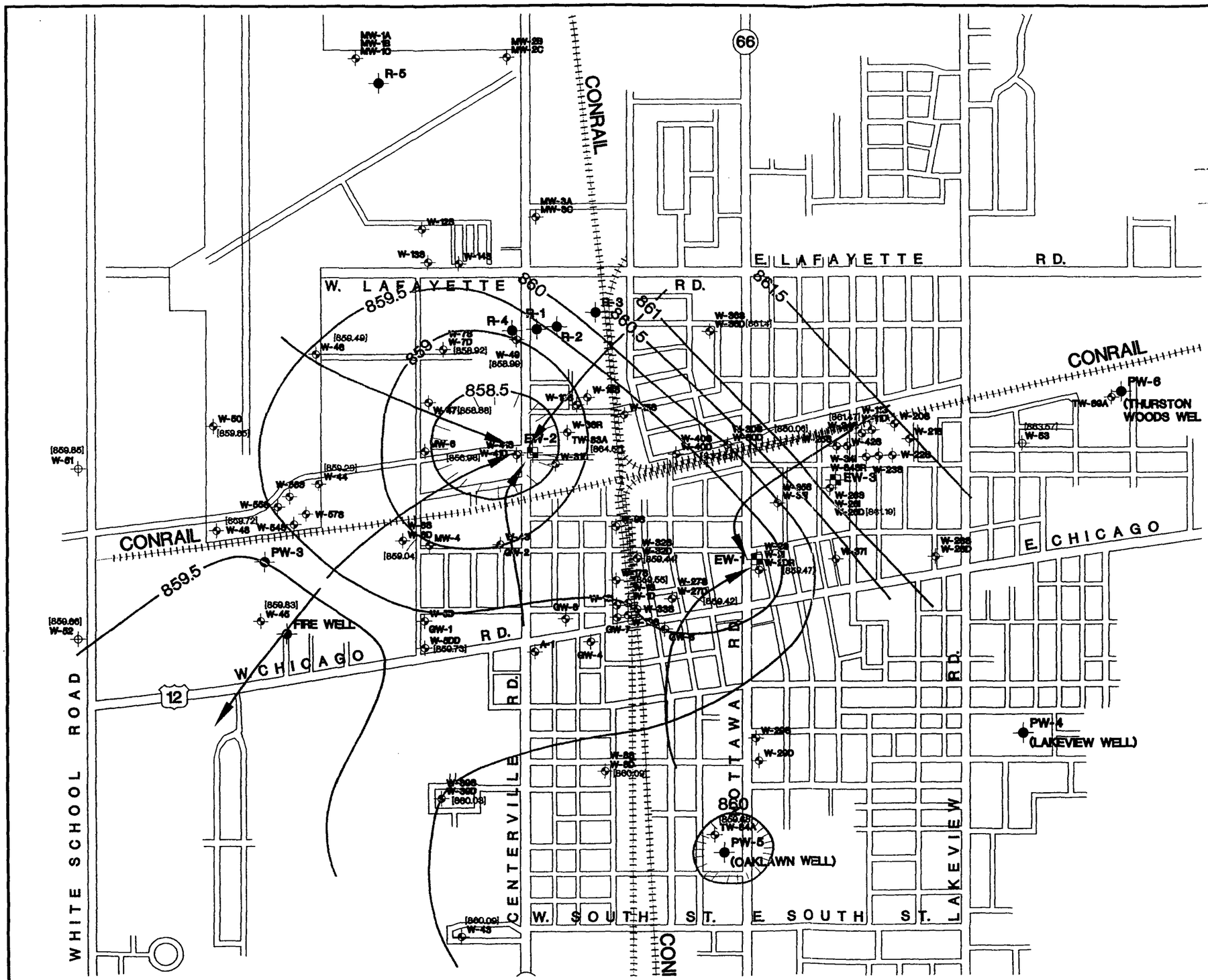

EXPLANATION

PW-3 — PUBLIC OR INDUSTRIAL WATER SUPPLY WELL LOCATION AND DESIGNATION

W-8D [860.09] — EXISTING MONITOR WELL LOCATION, DESIGNATION, AND POTENTIOMETRIC ELEVATION (ft. msl)

862 — POTENTIOMETRIC SURFACE CONTOUR (ft. msl) CONTOUR INTERVAL 1.0ft.

FLOW DIRECTION

N

SCALE

0 2400

Feet

NEWELL RUBBERMAID INC. STURGIS, MICHIGAN	DATE: 5/14/04
	DESIGNED: HJW
POTENTIOMETRIC SURFACE LOWER AQUIFER (April 27, 2004)	CHECKED: MRN
	APPROVED: MRN
	DRAWN: HJW
	PROJ.: 2206.001
GeoTrans, Inc. A TETRA TECH COMPANY	Figure 2

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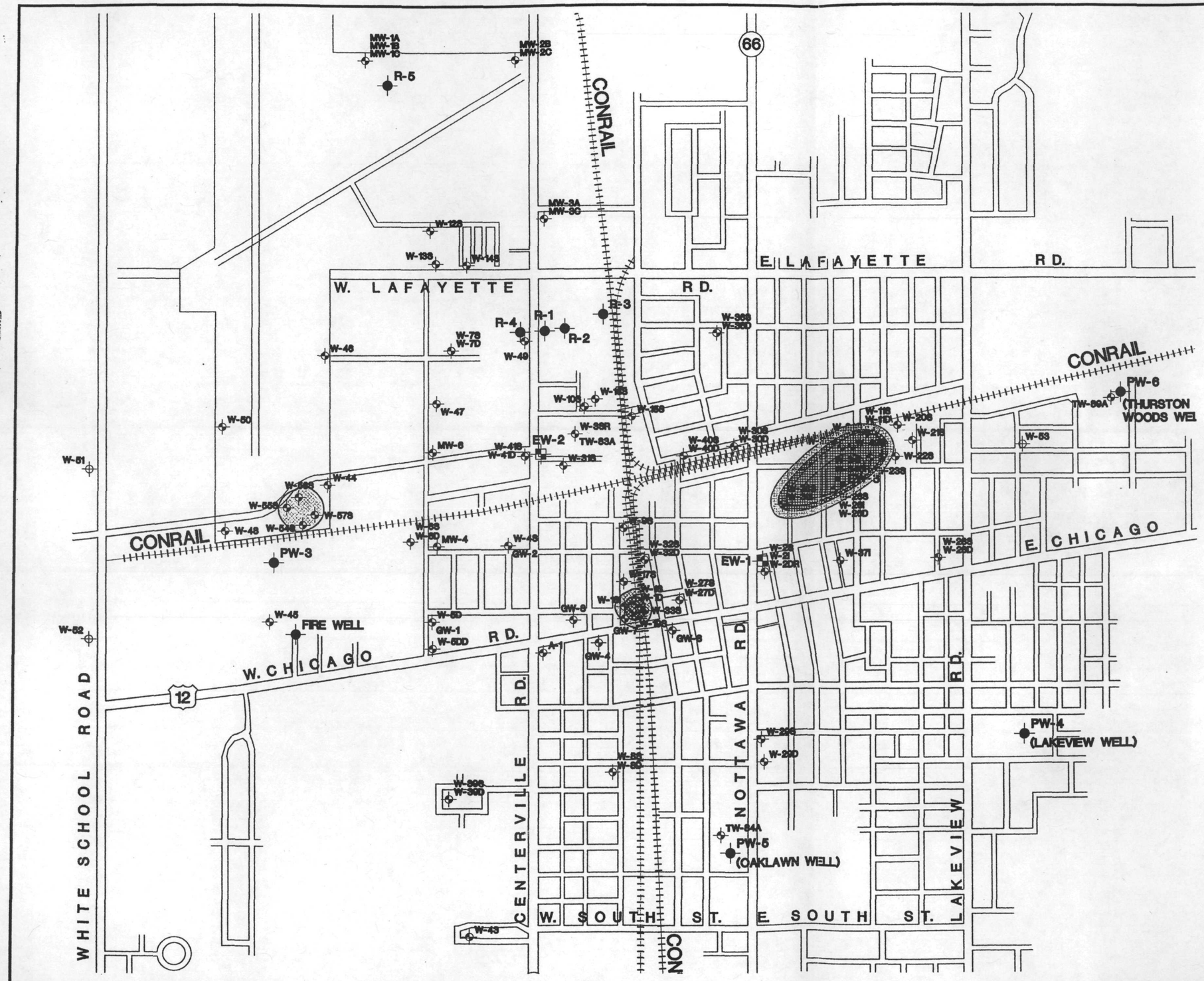

NEWELL RUBBERMAID INC. STURGIS, MICHIGAN	DATE: 6/9/04 DESIGNED: HJW
CONTAMINANT PLUME UPPER AQUIFER (April, 2004)	CHECKED: MRN APPROVED: MRN DRAWN: HJW PROJ.: 2208.001
GeoTrans, Inc. A TETRA TECH COMPANY	Figure 3

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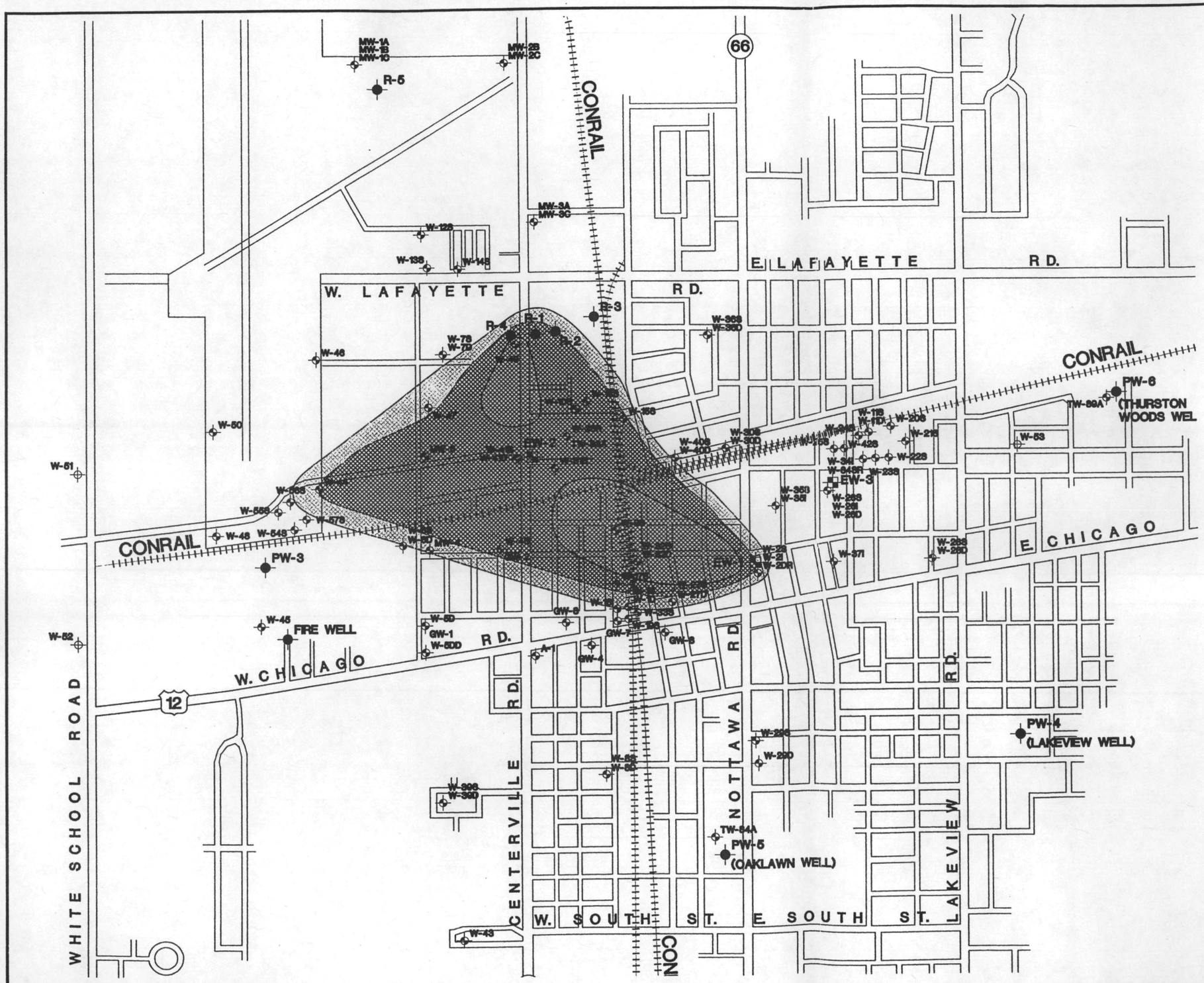

NEWELL RUBBERMAID INC. STURGIS, MICHIGAN	DATE: 6/9/04 DESIGNED: HJW CHECKED: MRN APPROVED: MRN DRAWN: HJW PROJ: 2208.001
CONTAMINANT PLUME LOWER AQUIFER (April, 2004)	
GeoTrans, Inc. A TETRA TECH COMPANY	Figure 4

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TABLES

Table 1. Groundwater Elevation Data April 27, 2004

Well I.D.	TOC Elevation (ft)	WL Depth (ft)	WL Elevation (ft)
W-1S	908.68	47.28	861.4
W-1D	907.67	48.12	859.55
W-2S	922.48	62.59	859.89
W-2DR	922.72	63.25	859.47
W-5DD	906.61	46.88	859.73
W-6S	910.15	33.73	876.42
W-6D	910.14	51.10	859.04
W-7S	919.50	57.96	861.54
W-7D	919.44	60.52	858.92
W-8S	907.02	33.43	NA
W-8D	906.44	46.35	860.09
W-11S	931.56	>66.45	<865.11
W-11D	931.28	69.81	861.47
W-13S	924.26	62.40	861.86
W-14S	924.39	62.22	862.17
W-15S	919.26	58.18	861.08
W-19S	909.08	47.57	861.51
W-20S	932.34	67.90	864.44
W-21S	931.32	66.95	864.37
W-22S	929.74	66.44	863.3
W-23S	927.66	>62.39	<865.27
W-24S	930.95	68.32	862.63
W-25S	928.47	bent	NA
W-26S	924.73	>65.90	<858.83
W-26I	925.08	71.17	853.91
W-26D	925.02	63.83	861.19
W-27S	908.39	48.44	859.95
W-27D	908.03	48.61	859.42
W-28S	929.14	66.83	862.31
W-28D	929.57	obstructed	NA
W-29S	913.19	bent	NA
W-29D	911.18	obstructed	NA
W-30S	922.43	61.08	861.35
W-30D	921.25	61.19	860.06

Well I.D.	TOC Elevation (ft)	WL Depth (ft)	WL Elevation (ft)
W-32S	917.04	56.22	860.82
W-32D	917.76	58.32	859.44
W-34SR	930.70	68.86	861.84
W-34I	930.66	69.35	861.31
W-35S	921.44	obstructed	NA
W-35I	921.02	60.62	860.4
W-36S	919.79	57.51	862.28
W-36D	919.61	58.21	861.4
W-39S	900.81	36.98	863.83
W-39D	900.59	40.56	860.03
W-40S	920.47	59.84	860.63
W-40D	920.55	61.22	859.33
W-41S	911.35	49.5	861.85
W-41D	911.72	54.74	856.98
W-42S	928.17	>64.20	<863.97
MW-6	909.66	38.04	871.62
TW-83A	912.83	48.26	864.57
TW-84A	892.70	33.02	859.68
TW-89A	943.50	obstructed	NA
W-43	903.14	43.05	860.09
W-44	906.46	47.18	859.28
W-45	903.46	44.63	858.83
W-46	911.54	52.05	859.49
W-47	916.33	57.45	858.88
W-48	905.83	46.11	859.72
W-49	921.46	62.47	858.99
W-50	906.06	46.41	859.65
W-51	904.97	45.12	859.85
W-52	900.42	40.76	859.66
W-53	933.47	69.90	863.57
W-54S	906.26	39.15	867.11
W-55S	904.87	37.32	867.55
W-56S	904.68	36.34	868.34
W-57S	903.21	35.14	868.07

Well ID	W-1S	W-11S	W-19S	W-23S	W-26S	W-26I	W-34SR	W-35I	W-42S	W-2DR	W-5DD	W-26D	W-27D	W-32D	W-40D
Acetone		NS		NS	NS	6.9			NS					8J	
Benzene		NS		NS	NS				NS						
Ethylbenzene		NS		NS	NS				NS						
2-Butanone (MEK)		NS		NS	NS	1.3J			NS						
MTBE		NS		NS	NS				NS						
Naphthalene		NS		NS	NS				NS						
Propylbenzenes		NS		NS	NS				NS						
Toluene		NS		NS	NS				NS						
Total Xylenes		NS		NS	NS				NS						
Trimethylbenzenes		NS		NS	NS				NS						
CHLORINATED VOCs															
1,1,1-Trichloroethane		NS		NS	NS				NS						
1,1,2-Trichloroethane	1.3	NS		NS	NS				NS						
1,1-Dichloroethane		NS		NS	NS				NS						
1,1-Dichloroethene		NS		NS	NS				NS						
1,2-Dichloroethane		NS		NS	NS				NS						
Bromodichloromethane		NS		NS	NS				NS						
Carbon Tetrachloride		NS		NS	NS				NS						
Chloroform		NS		NS	NS				NS						
cis-1,2-Dichloroethene		NS		NS	NS				NS						
Dibromochloromethane		NS		NS	NS				NS						
Dichlorodifluoromethane		NS		NS	NS				NS						
Methylene Chloride		NS		NS	NS	1B			NS		1.7B	6.3B	2.3B	2.8B	1.5B
Tetrachloroethene	1.1	NS		NS	NS		7		NS	1.9					
trans-1,2-Dichloroethene		NS		NS	NS				NS						
Trichloroethene	77	NS	44	NS	NS	1.2	230	21	NS	32			2.4	650	
Total Chlorinated VOCs	79.4	0	44	0	0	1.2	237	21	0	33.9	0	0	2.4	650	0

Samples collected April 28-29, 2004
All values in ug/L
Blank = concentration below reporting limit
J = result is an estimated value below the reporting limit
B = compound was detected in trip blank
NS = well dry, no sample collected

Table 2. First 2004 Semiannual Monitoring Event Analytical Results.

Well ID	W-41D	W-44	W-45	W-46	W-47	W-48	W-49	W-50	W-53	W-54S	TW-84A	Trip Blank
Acetone												
Benzene												
Ethylbenzene												
2-Butanone (MEK)												
MTBE												
Naphthalene												
Propylbenzenes												
Toluene												
Total Xylenes												
Trimethylbenzenes												
CHLORINATED VOCs												
1,1,1-Trichloroethane	1.3				2.9							
1,1,2-Trichloroethane												
1,1-Dichloroethane												
1,1-Dichloroethene												
1,2-Dichloroethane												
Bromodichloromethane												
Carbon Tetrachloride												
Chloroform												
cis-1,2-Dichloroethene		1.2			1.4							
Dibromochloromethane												
Dichlorodifluoromethane												
Methylene Chloride	2.1B	1.9B			1.5B					1.5B		27
Tetrachloroethene												
trans-1,2-Dichloroethene												
Trichloroethene	210	200			54		520			4.4		
Total Chlorinated VOCs	211.3	201.2	0	0	58.3	0	520	0	0	4.4	0	27

Samples collected April 28-29, 2004
All values in ug/L
Blank = concentration below reporting limit
J = result is an estimated value below the reporting limit
B = compound was detected in trip blank
NS = well dry, no sample collected

Table 3. Historical Total Chlorinated VOC Concentrations

Well ID	Jul-92	Jul-93	Jun-94	Nov-94	Apr-95	Oct-95	Apr-96	Nov-96	Jun-97	Oct-97	Apr-98	Oct-98
W-1S	336.6	210	183.6	141	140.8	120	100.9	96.8	79.9	78.5	58	87
W-11S	33.9	--	--	--	6	25	--	182	101	29	5.7	6
W-19S	205	306	123	84	20.5	45	14.7	127	106	57.8	83	104
W-23S	12,063.50	8,896	5,653	2,700	1,314	1,300	1,028	5,300	3,500	2,516.70	680	426
W-26S	4,604	2,723	9,100	8,500	8,718	11,000	10,064	10,000	6,100	5,526	2,900	2313.7
W-42S	5,084	7,094	6,481	2,228	1,517.80	1,820	426	610	969	1,411	860	470.6
W-2DR	2,500	1,789	1,200	1,003	2,000	800	1,201	50	26.7	17	9.8	7
W-5DD										3	0.7	
W-26D	1	1	0.8	0.9	0.8	0.6				0.6		
W-27D	7,203.50	4,352	3,306.40	1,403.60	5,200	4,452	1,200	--	86	26	14.51	23
W-32D	6,605	6,031	5,100	3,505	5,500	5,600	6,300	8,400	11,000	11,010	6,300	6403
W-40D	1.6			1								
W-41D	226.8	972.9	2,811.50	3,200	5,000	5,405	5,900	5,600	3,408.20	2,550	2,100	2900
W-44	--	--	--	--	193	237	180	276	243	192	160	180.8
W-45	--	--	--	--	0.6							
W-46	--	--	--	--								
W-47	--	--	--	--	--	--	--	216	186	199	180.3	147.9
W-48	--	--	--	--	--	--	--					--
W-49	--	--	--	--	--	--	--	190	125.3	158	4.4	392
W-50	--	--	--	--	--	--	--	--	--			
W-51	--	--	--	--	--	--	--	--	--	--	--	--
W-52	--	--	--	--	--	--	--	--	--	--	--	--
W-53	--	--	--	--	--	--	--	--	--	--	--	--
W-54S	--	--	--	--	--	--	--	--	--	--	--	--
W-55S	--	--	--	--	--	--	--	--	--	--	--	--
W-56S	--	--	--	--	--	--	--	--	--	--	--	--
W-57S	--	--	--	--	--	--	--	--	--	--	--	--
TW-84A	0.9		6		1							

All values in ug/L.
Blank indicates concntration below reporting limit.
Dash indicates no sample collected.

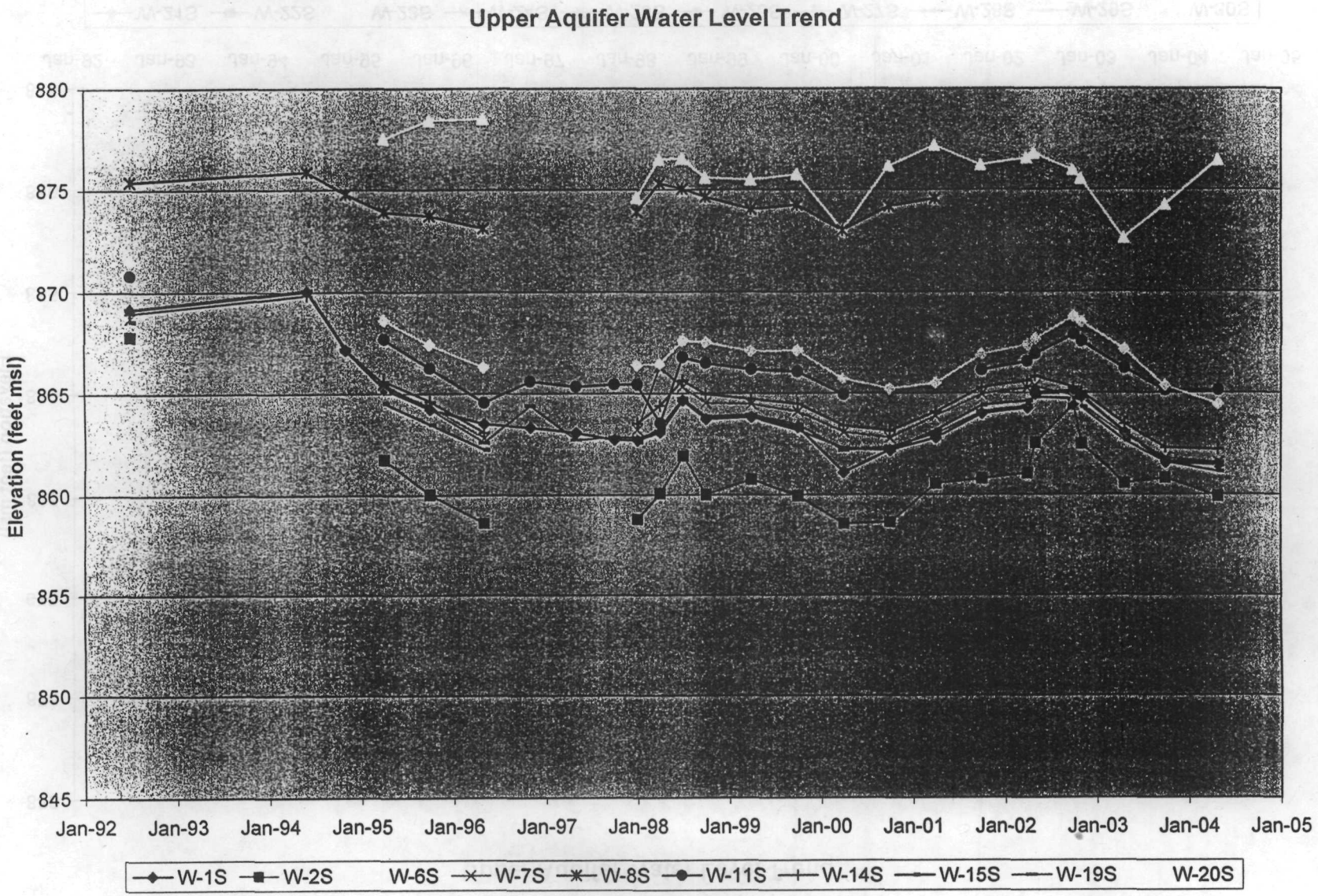
Table 3. Historical Total Chlorinated VOC Concentrations

Well ID	Apr-99	Oct-99	Apr-00	Oct-00	Apr-01	Oct-01	Apr-02	Oct-02	Apr-03	Oct-03	Apr-04
W-1S	123	101.9	101.9	113	103	103	124	113.4	134.8	93.9	79.4
W-11S	0.6	0.9		2	3	4.7	3.73	3.94		0.57	--
W-19S	124	114	71	67	66	95	67.05	102.3	65	70	44
W-23S	306	235	155	155	154	114	92.7	65.2	55.4	45	--
W-26S	2519.6	2313.8	2719.5	3323.8	2615	2616.5	2318.9	3017.4	1800	1611	--
W-42S	867	286	95	113	148.9	150.9	120.86	79.4	121	106	--
W-2DR	8	6	4	4.6	4.8	4	3.6	4.7	4.7	45.63	33.9
W-5DD	--										
W-26D											
W-27D	21	15	14	13	8	9	32	6.6	3.6	3.3	2.4
W-32D	7903	4702	6002	3201	3801.8	4600.9	3600	3602.6	2000	1400	650
W-40D	3.8	0.6		2.6	0.9						
W-41D	3006	1404	1202.8	2606	830.7	995	770	270	200	210	211.3
W-44	200.7	210	150.8	171.4	160.8	180.9	151.2	170.95	170	181.1	201.2
W-45			2								
W-46											
W-47	220.7	201.6	168.1	189.7	171.2	47.6	94.52	40.97	61.3	75.7	58.3
W-48											
W-49	1511.8	1713.6	1111	1206.2	1104.2	1104.5	940	1500	1500	1000	520
W-50											
W-51	--	--	--	--	--				--	--	--
W-52	--	--	--	--	--				--	--	--
W-53	--										
W-54S	--	--	--	--	--	4	4.4	5.7	4.9	7.5	4.4
W-55S	--	--	--	--	--	7	6.8	9.4	--	--	--
W-56S	--	--	--	--	--	9	9	7	--	--	--
W-57S	--	--	--	--	--	4	7.4	8.7	--	--	--
TW-84A											

All values in ug/L.
Blank indicates concntration below reporting limit.
Dash indicates no sample collected.

CHARTS

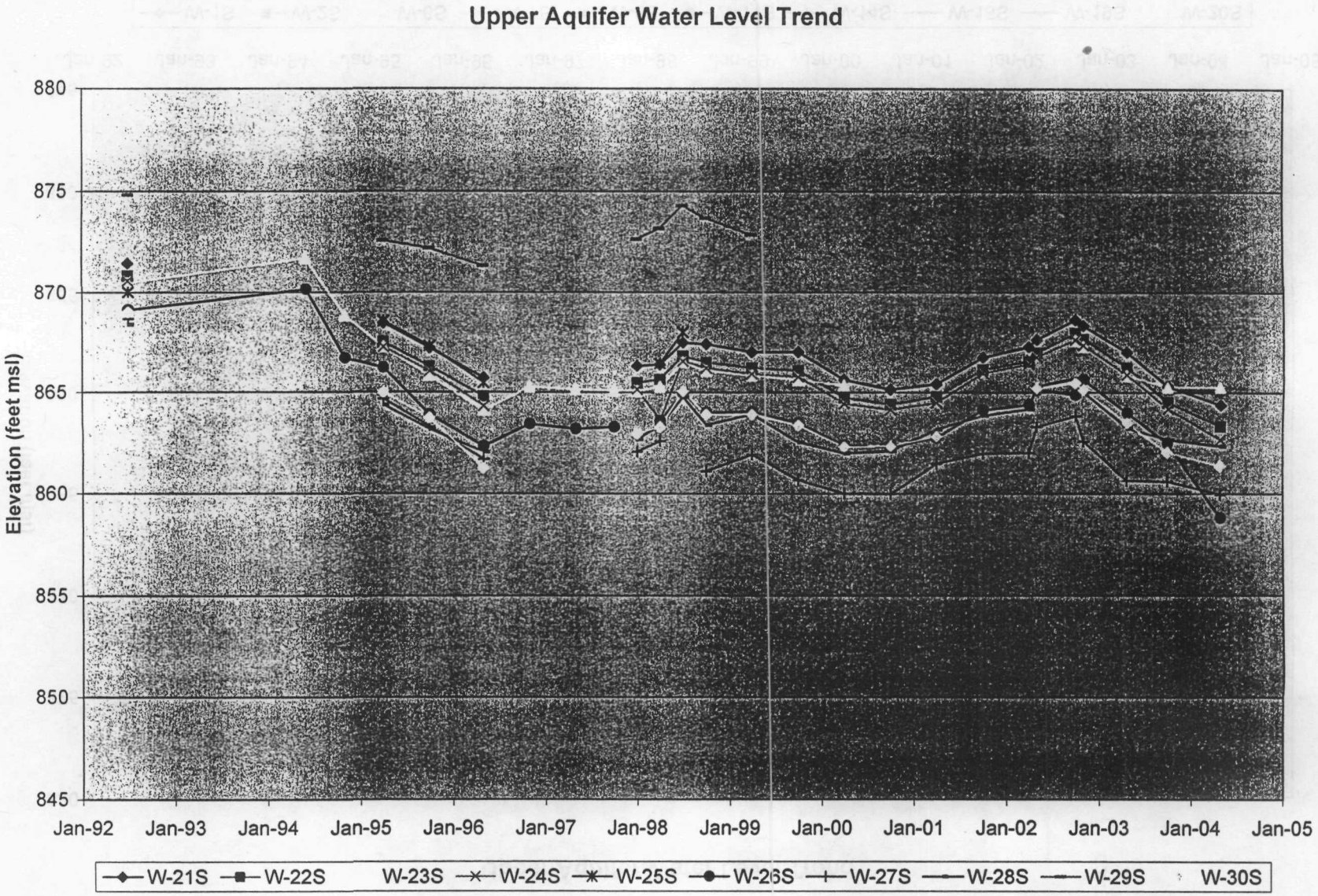
Chart 1



Wells 1-20

6/9/2004 WL_Hist.xls

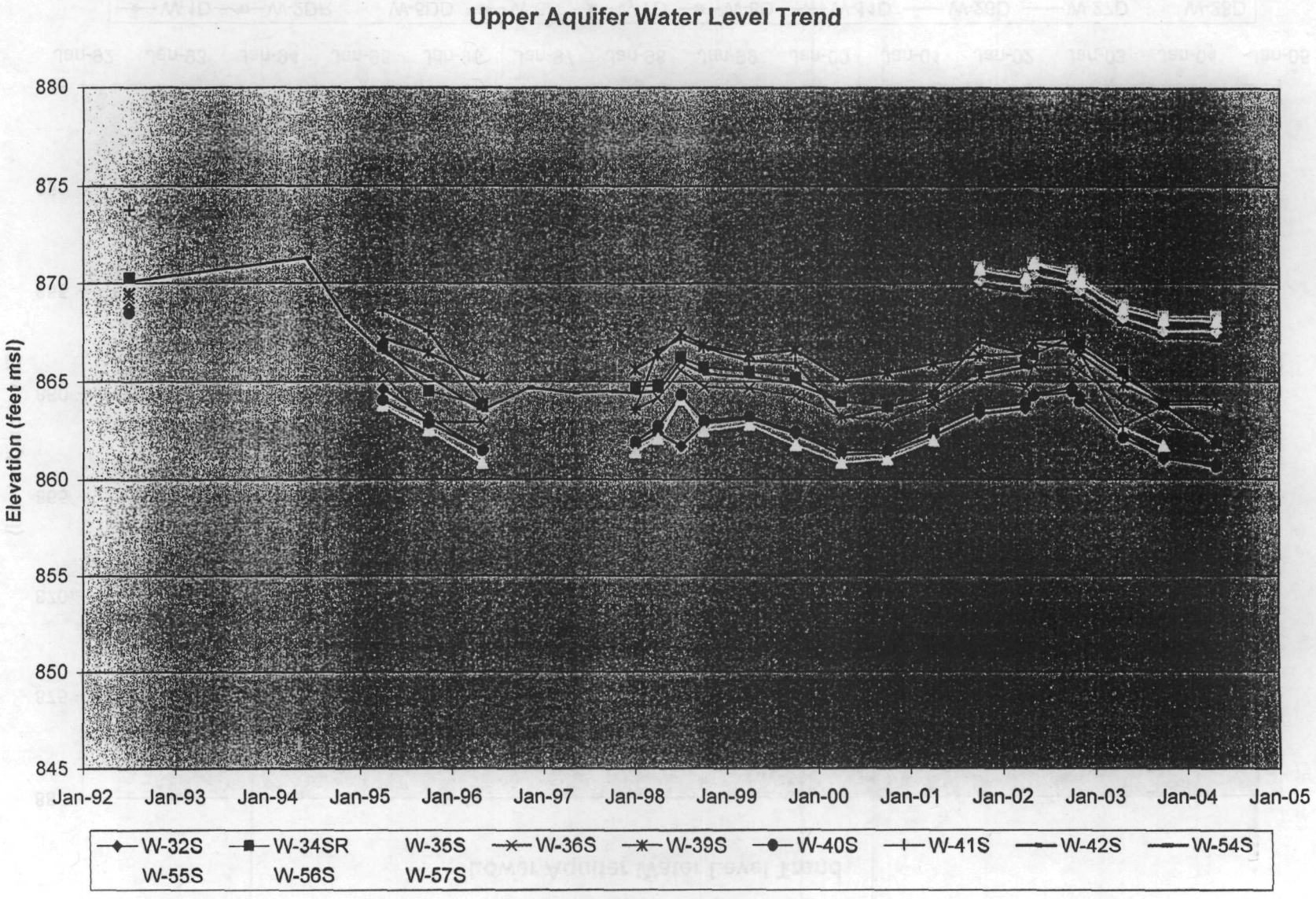
Chart 2



Wells 21-30

6/9/2004 WL_Hist.xls

Chart 3

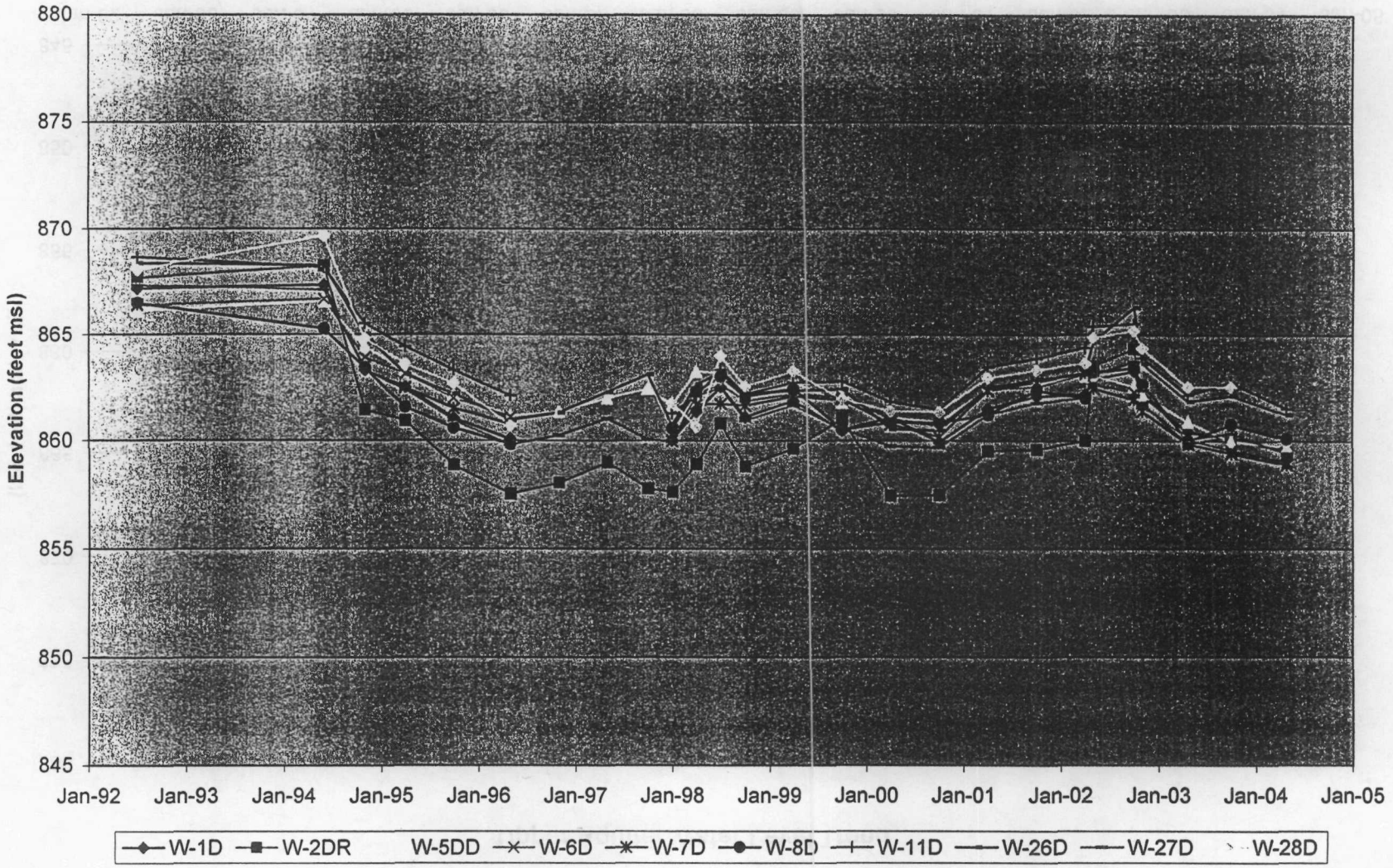


Wells 32-42, 54-57

6/9/2004 WL_Hist.xls

Chart 4

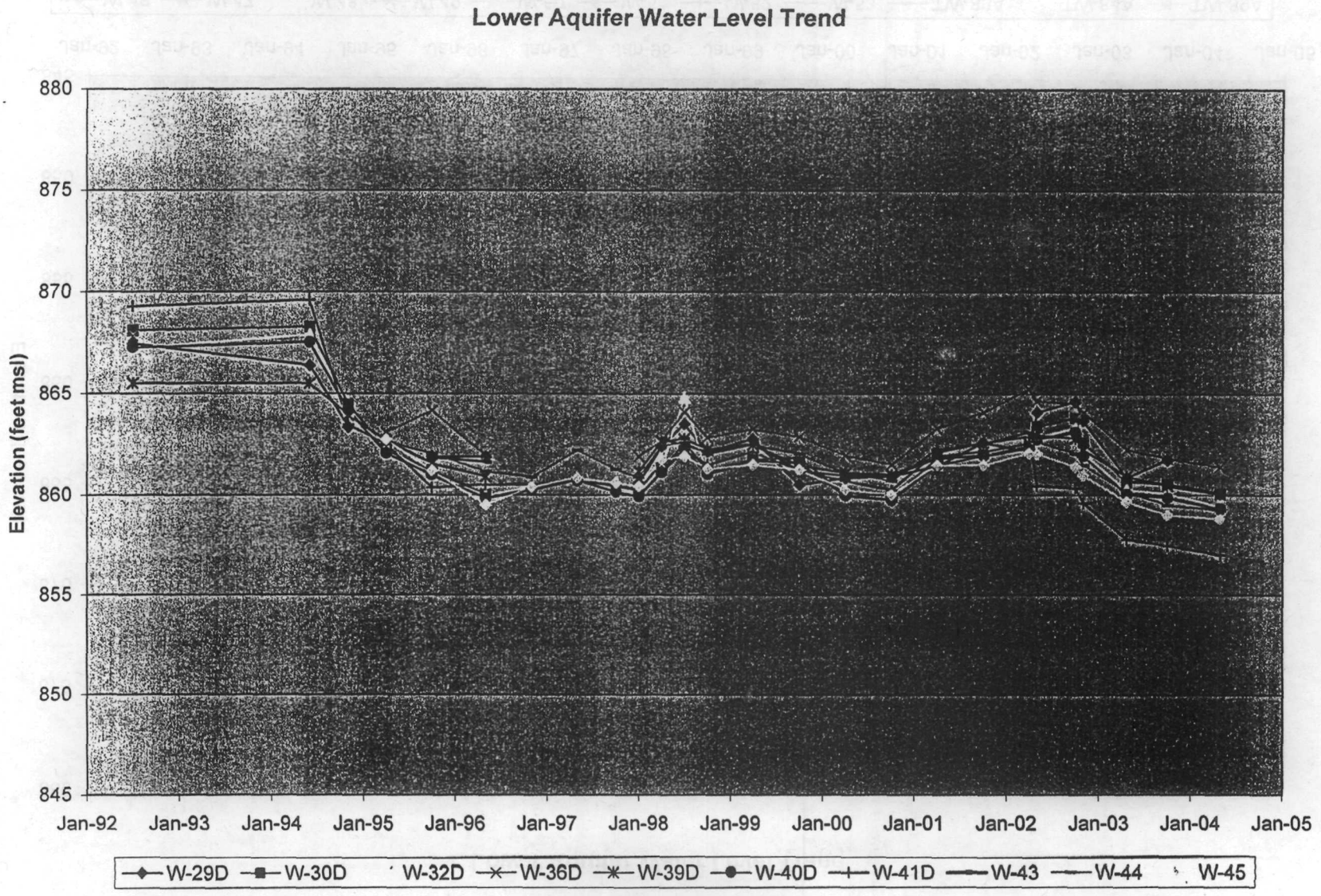
Lower Aquifer Water Level Trend



Wells 1-28

6/9/2004 WL_Hist.xls

Chart 5



Wells 29-45

6/9/2004 WL_Hist.xls

Chart 6

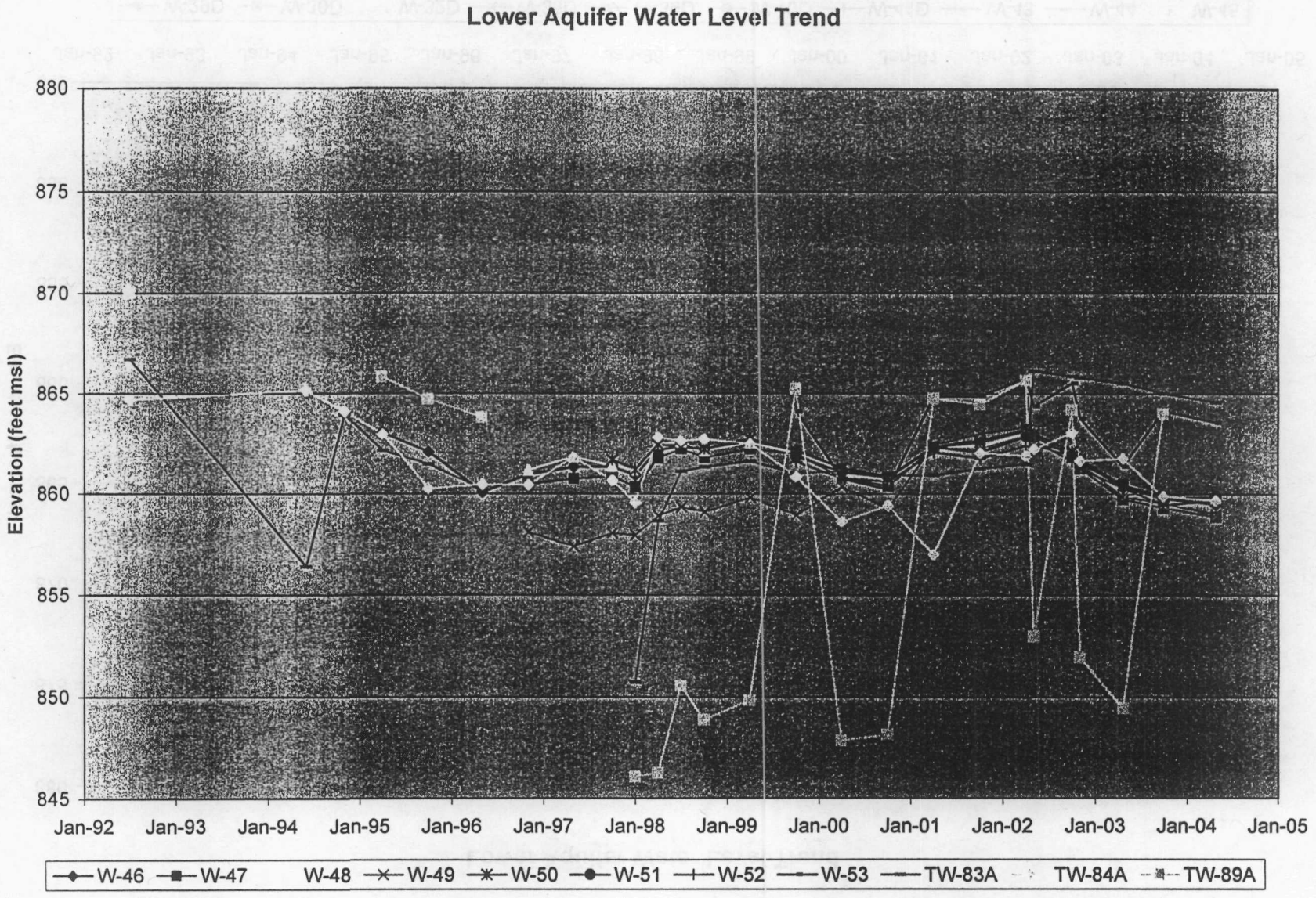
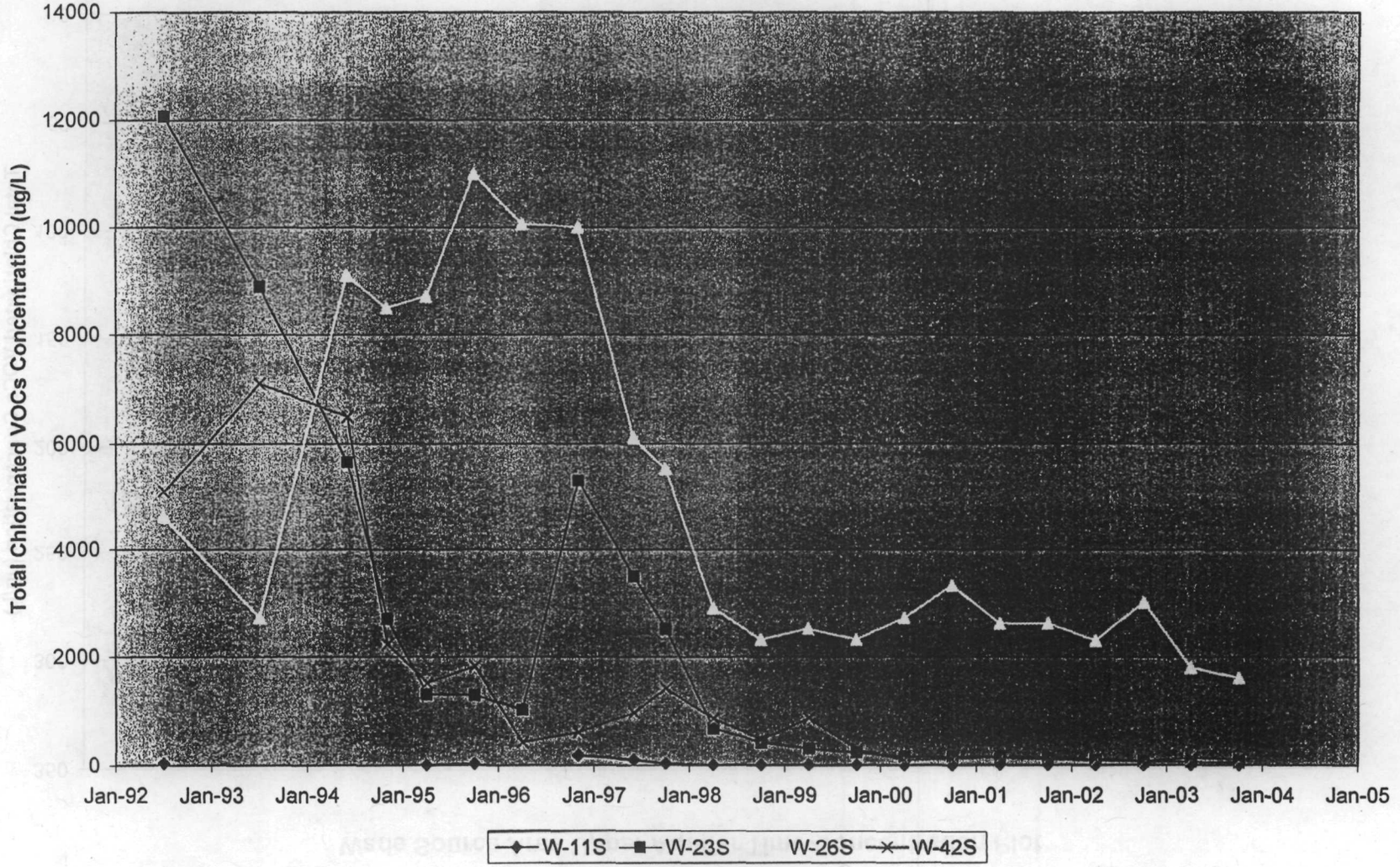

Lower Aquifer Water Level Trend
Elevation (feet msl)
880
875
870
865
860
855
850
845
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
W-46
W-47
W-48
W-49
W-50
W-51
W-52
W-53
TW-83A
TW-84A
TW-89A

Chart 7

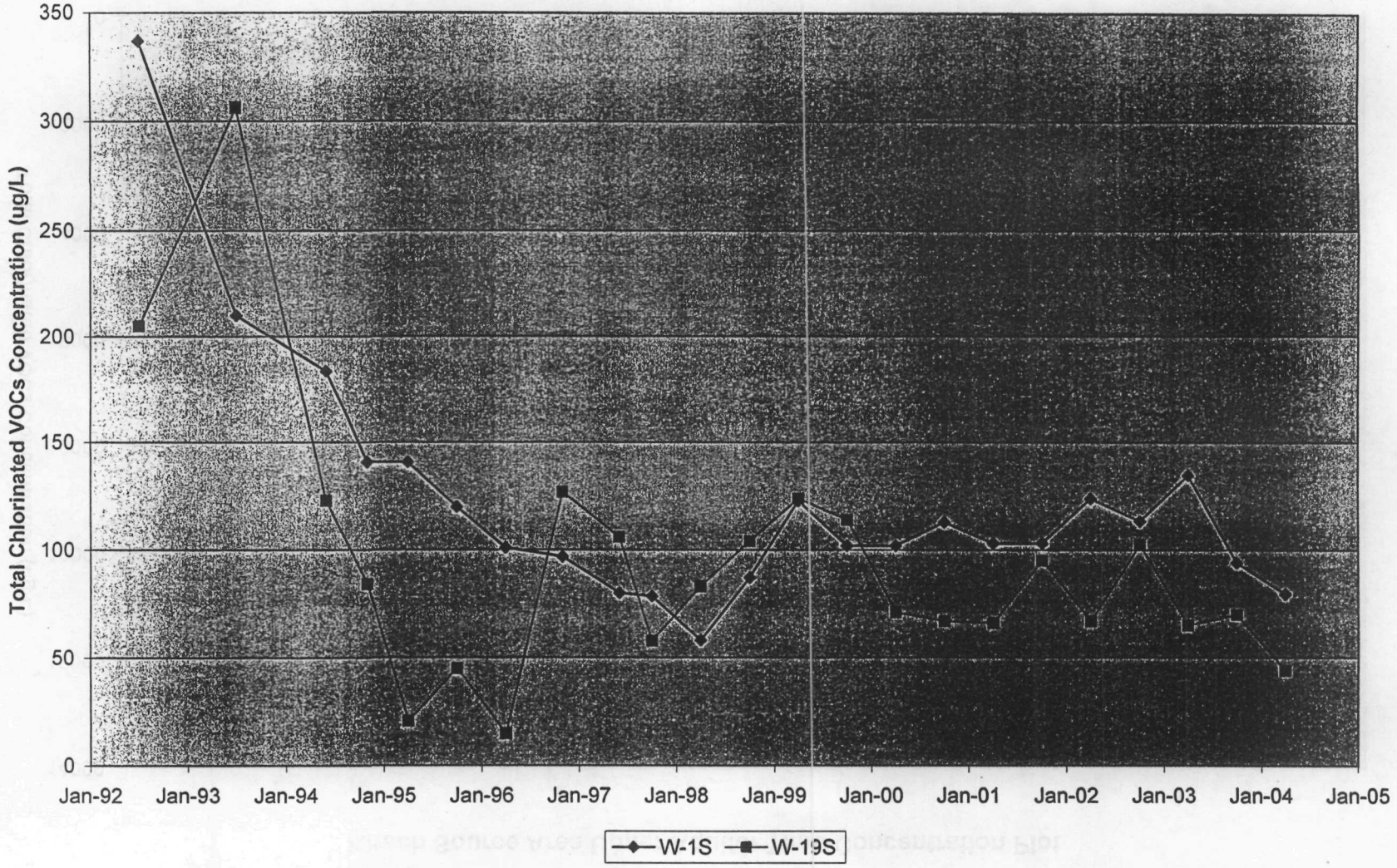
Kirsch Source Area Upper Aquifer Time-Concentration Plot



6/9/2004 WQ_Hist.xls

Chart 8

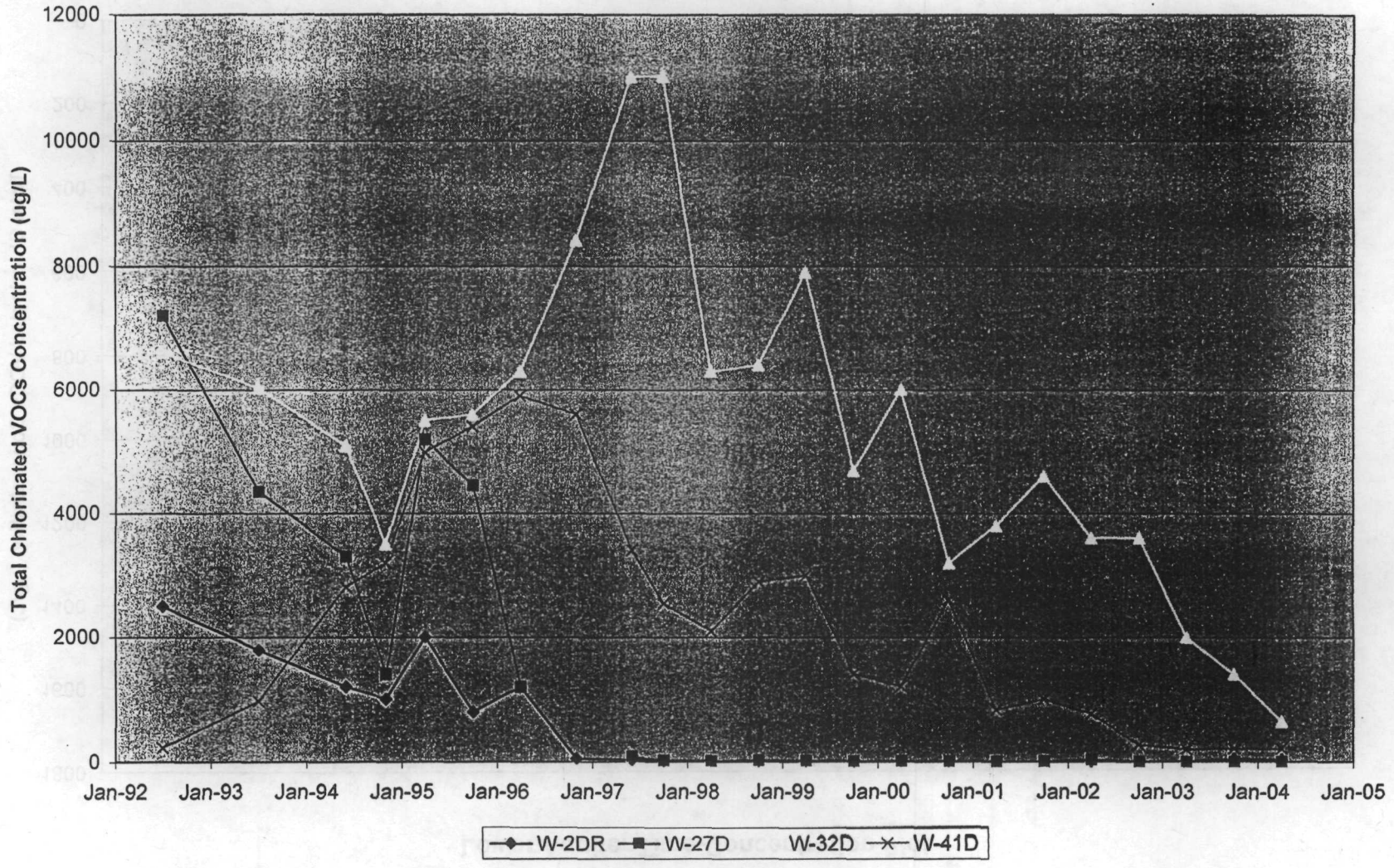
Wade Source Area Upper Aquifer Time-Concentration Plot



6/9/2004 WQ_Hist.xls

Chart 9

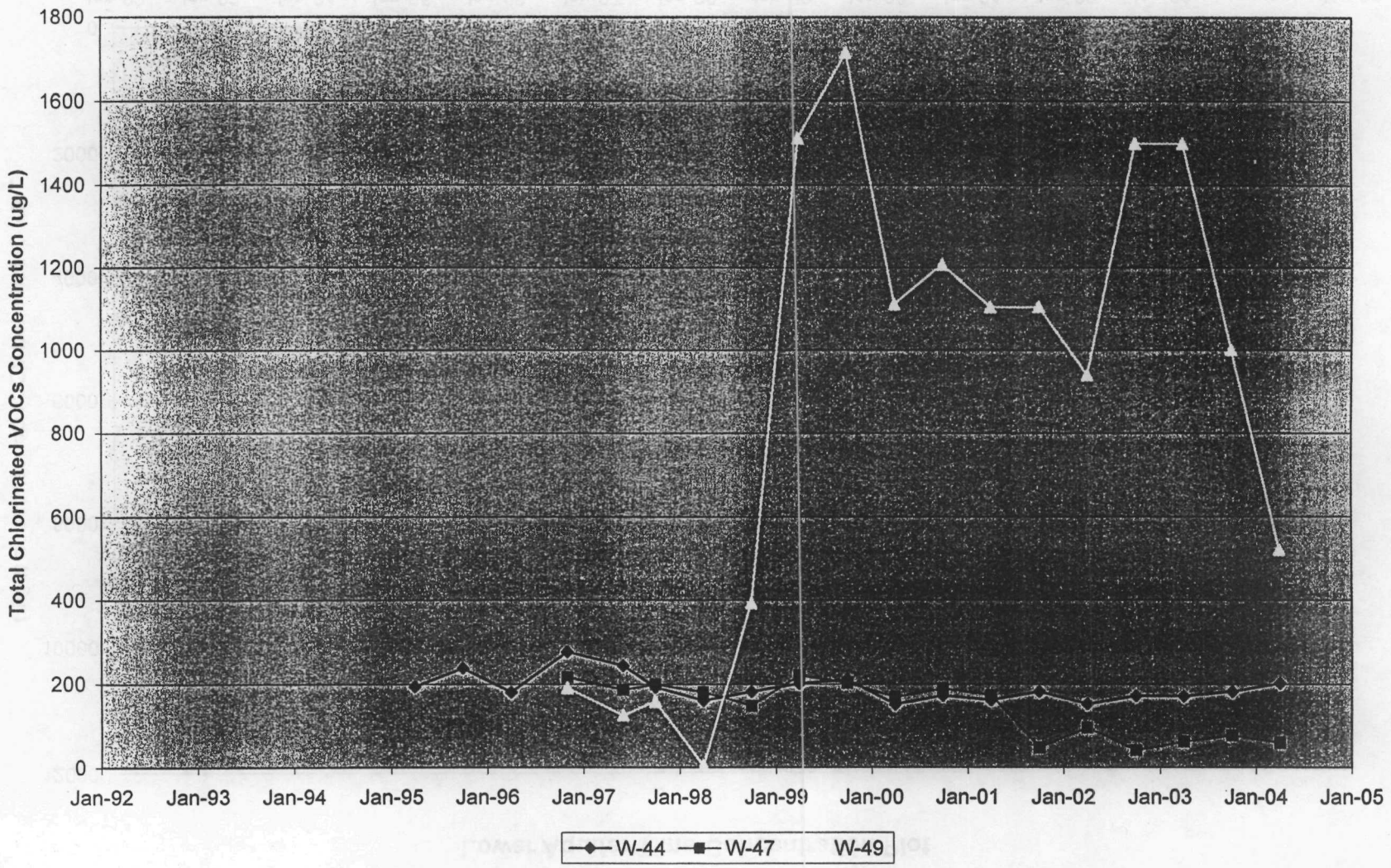
Lower Aquifer Time-Concentration Plot



6/9/2004 WQ_Hist.xls

Chart 10

Lower Aquifer Time-Concentration Plot



6/9/2004 WQ_Hist.xls

Chart 11

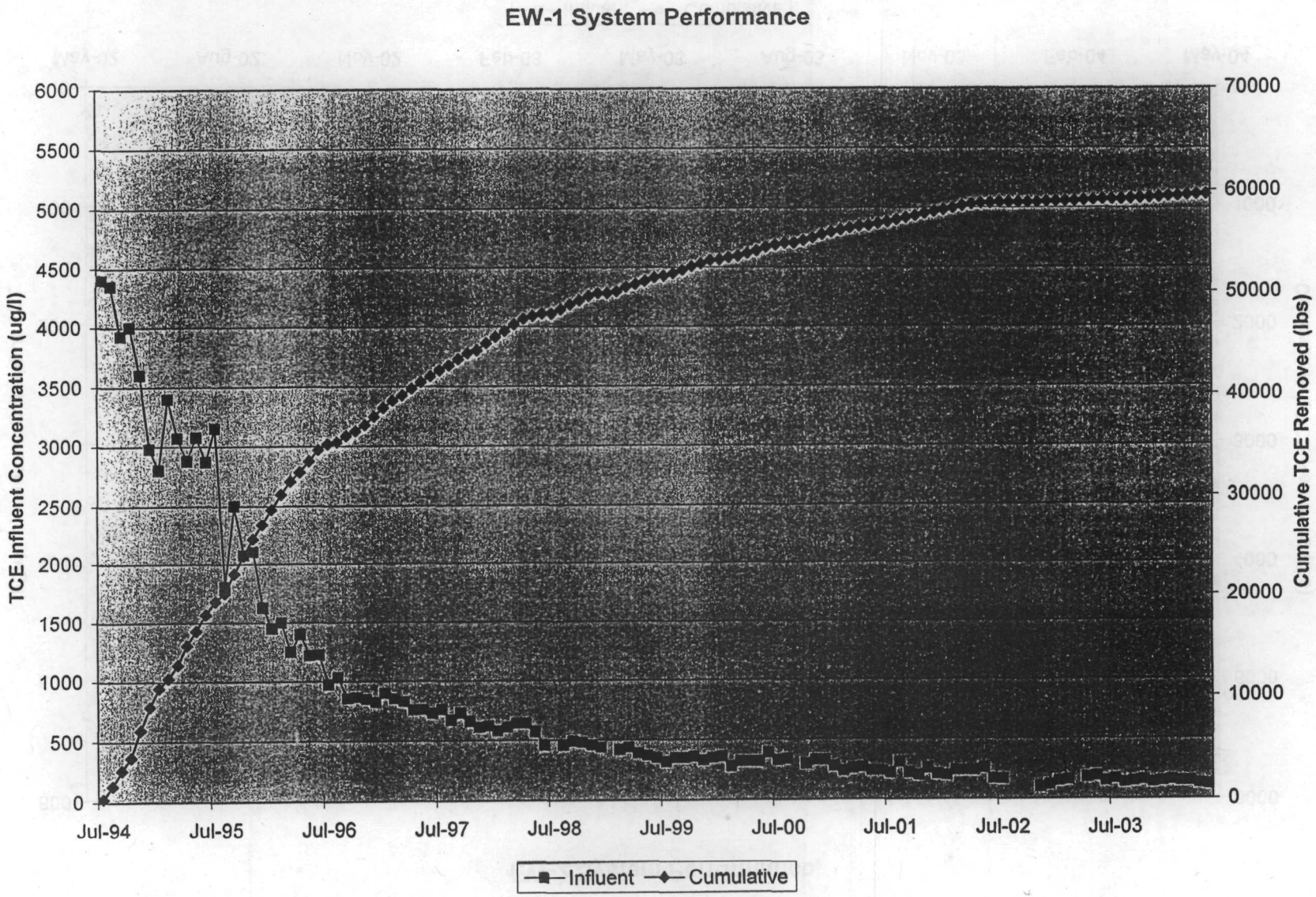

EW-1 System Performance
TCE Influent Concentration (ug/l)
Cumulative TCE Removed (lbs)
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
70000
60000
50000
40000
30000
20000
10000
0
Jul-94
Jul-95
Jul-96
Jul-97
Jul-98
Jul-99
Jul-00
Jul-01
Jul-02
Jul-03
Influent
Cumulative

Chart 12

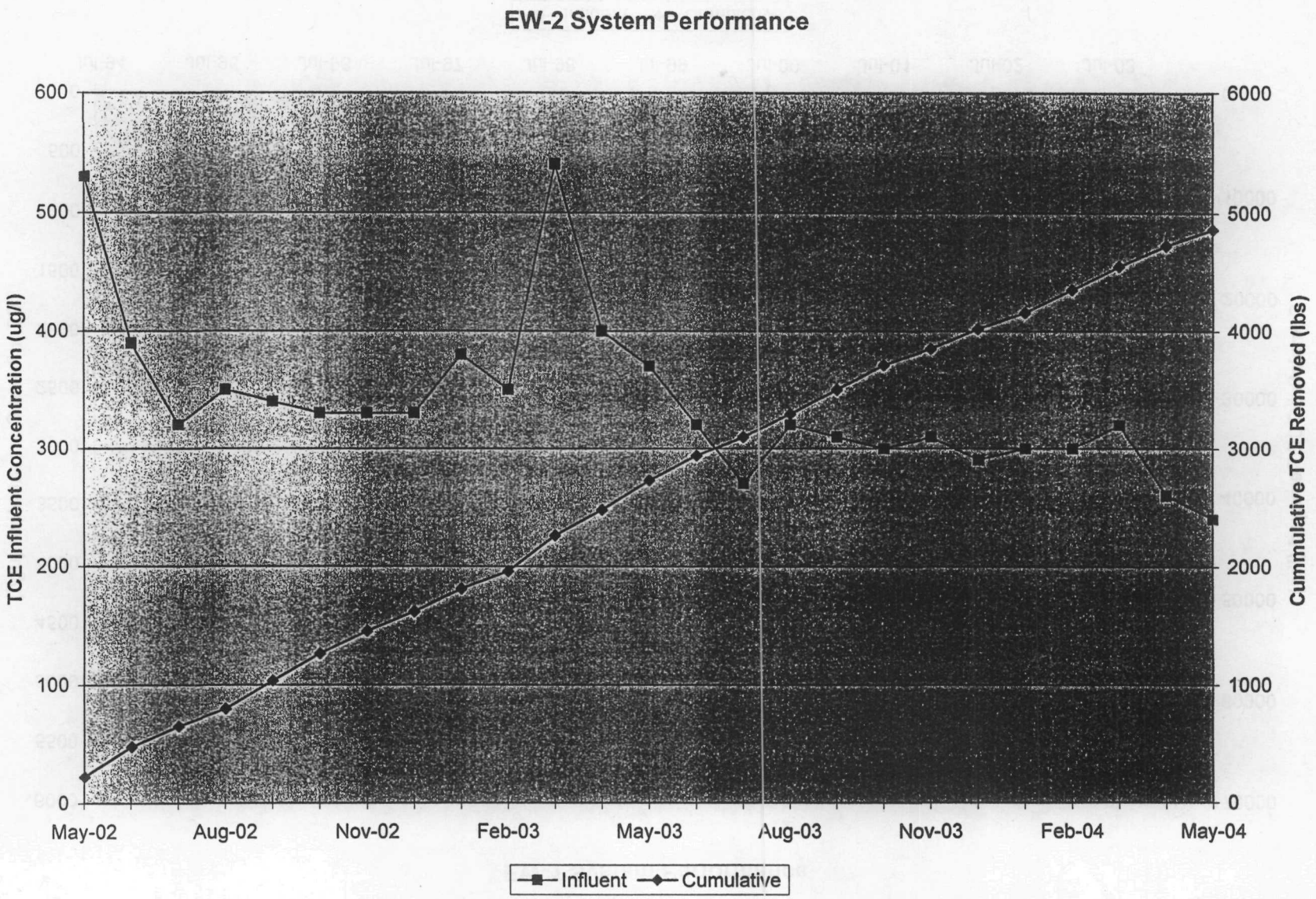

EW-2 System Performance
TCE Influent Concentration (ug/l)
Cummulative TCE Removed (lbs)
600
500
400
300
200
100
0
6000
5000
4000
3000
2000
1000
0
May-02
Aug-02
Nov-02
Feb-03
May-03
Aug-03
Nov-03
Feb-04
May-04
Influent
Cumulative

Chart 13

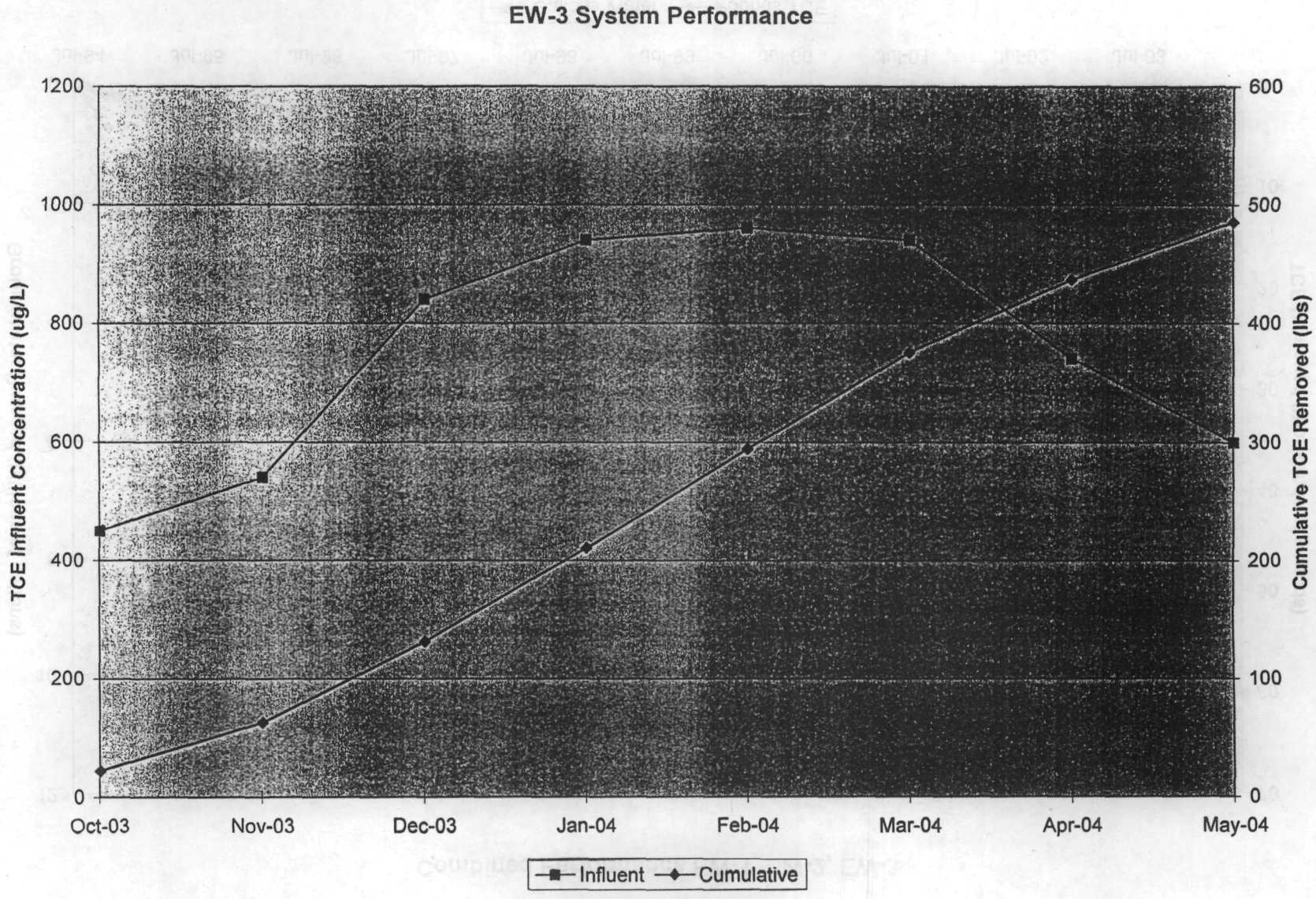
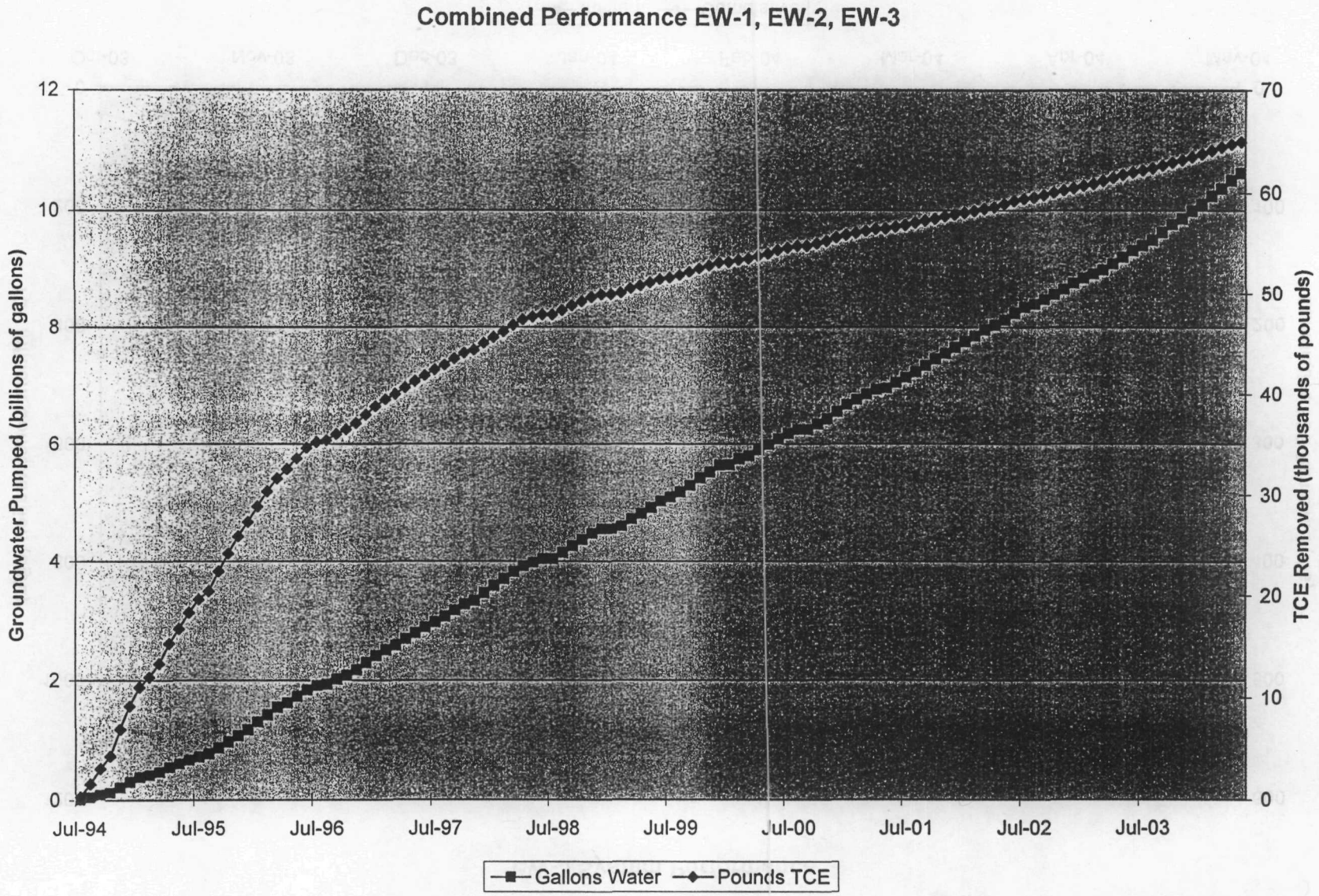

EW-3 System Performance
TCE Influent Concentration (ug/L)
Cumulative TCE Removed (lbs)
1200
1000
800
600
400
200
0
600
500
400
300
200
100
0
Oct-03
Nov-03
Dec-03
Jan-04
Feb-04
Mar-04
Apr-04
May-04
Influent
Cumulative

Chart 14


Combined Performance EW-1, EW-2, EW-3
Groundwater Pumped (billions of gallons)
TCE Removed (thousands of pounds)
0
2
4
6
8
10
12
0
10
20
30
40
50
60
70
Jul-94
Jul-95
Jul-96
Jul-97
Jul-98
Jul-99
Jul-00
Jul-01
Jul-02
Jul-03
Gallons Water
Pounds TCE

Attachment 4

Charts of System Performance

Chart 11

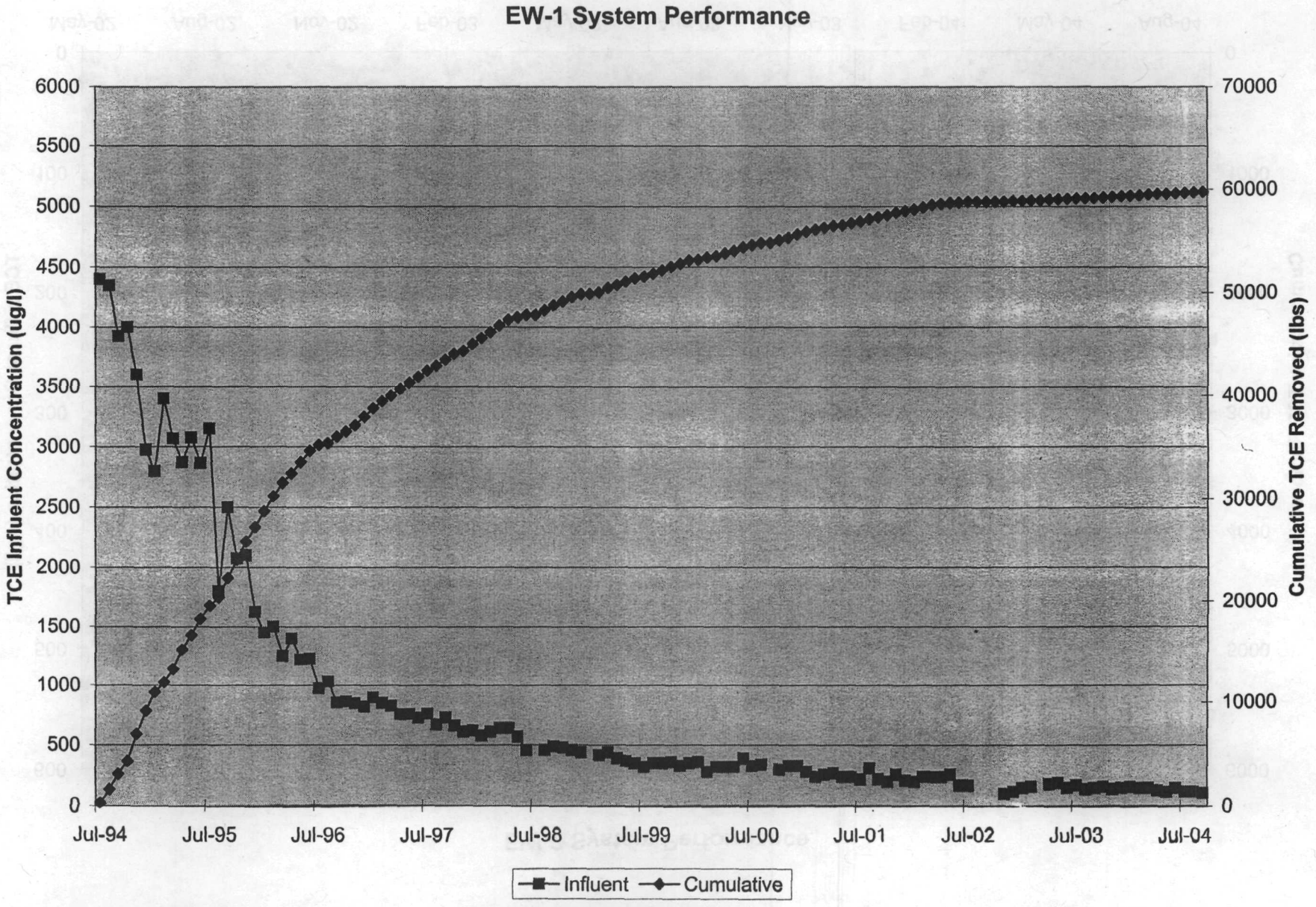

EW-1 System Performance
TCE Influent Concentration (ug/l)
Cumulative TCE Removed (lbs)
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
70000
60000
50000
40000
30000
20000
10000
0
Jul-94
Jul-95
Jul-96
Jul-97
Jul-98
Jul-99
Jul-00
Jul-01
Jul-02
Jul-03
Jul-04
Influent
Cumulative

Chart 12

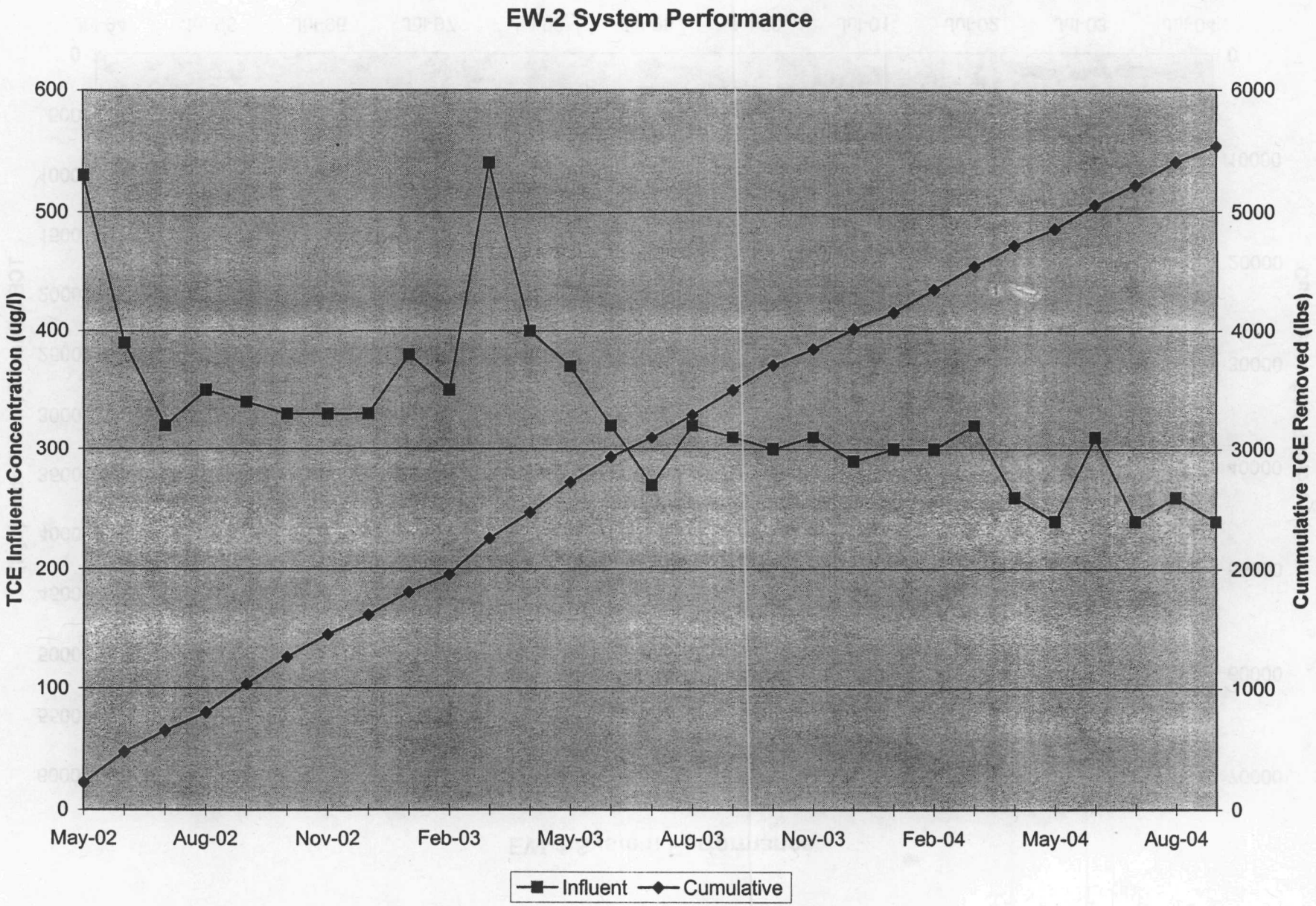

EW-2 System Performance
TCE Influent Concentration (ug/l)
Cummulative TCE Removed (lbs)
600
500
400
300
200
100
0
6000
5000
4000
3000
2000
1000
0
May-02
Aug-02
Nov-02
Feb-03
May-03
Aug-03
Nov-03
Feb-04
May-04
Aug-04
Influent
Cumulative

Chart 13

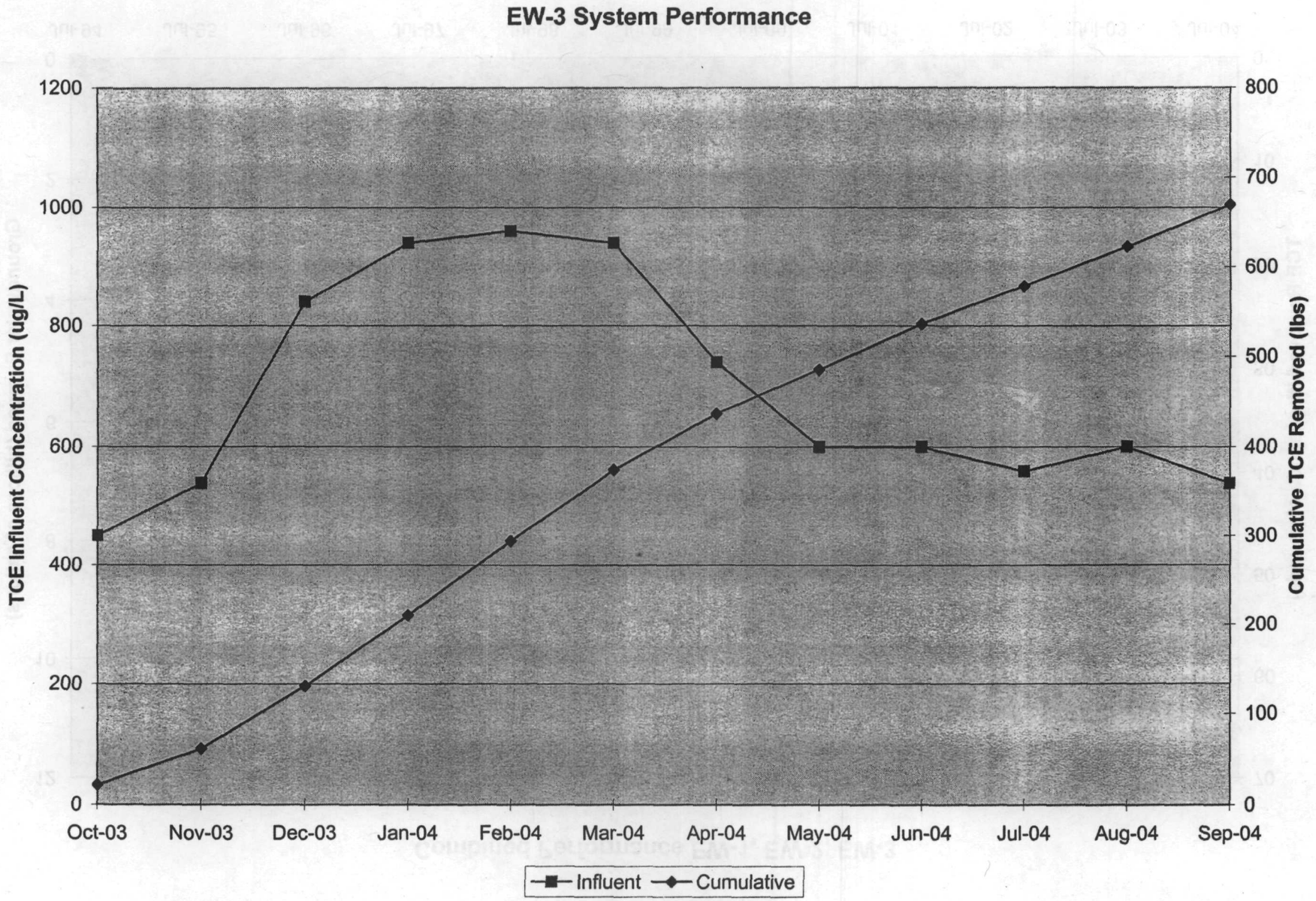
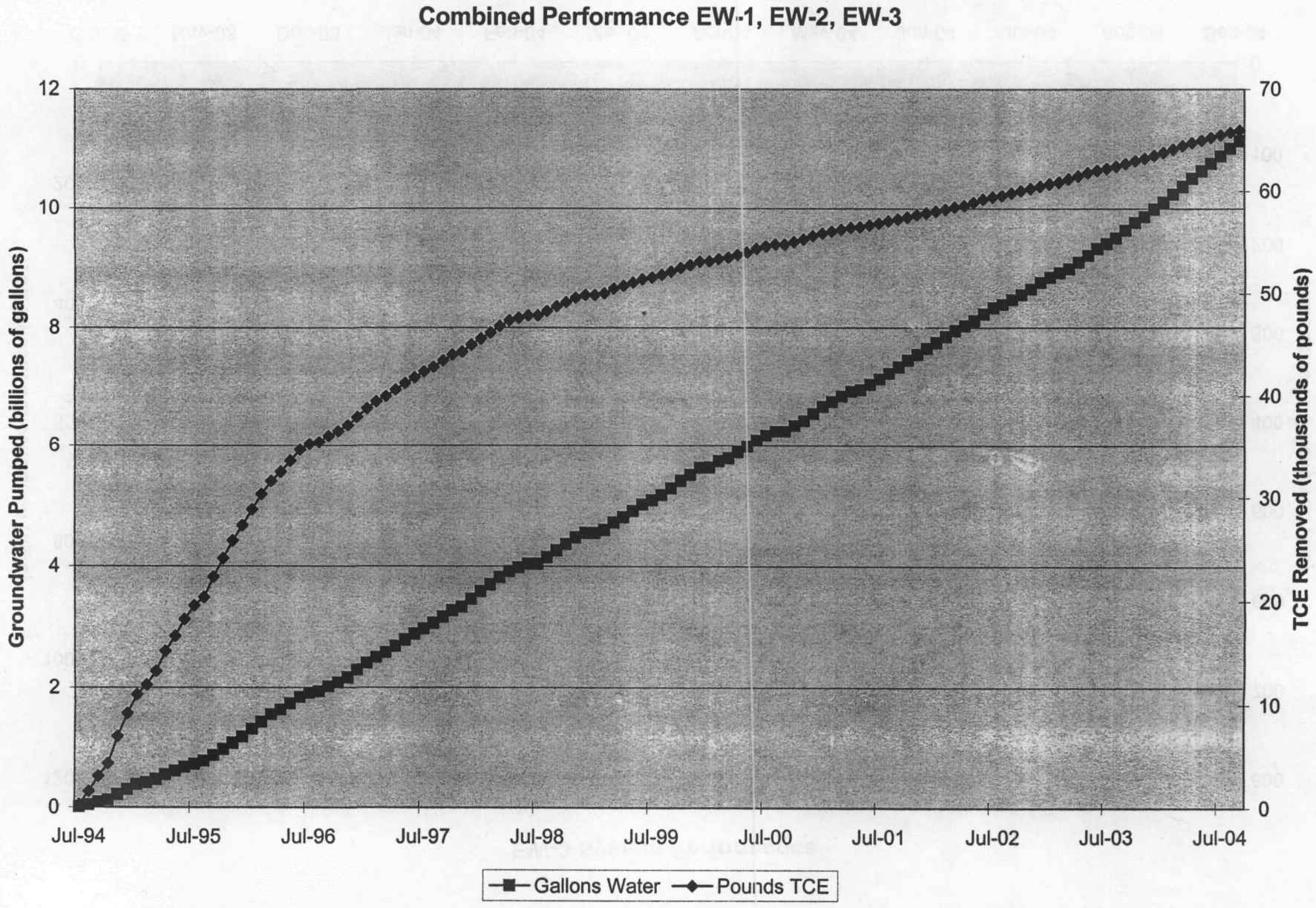

EW-3 System Performance
TCE Influent Concentration (ug/L)
Cumulative TCE Removed (lbs)
1200
1000
800
600
400
200
0
800
700
600
500
400
300
200
100
0
Oct-03
Nov-03
Dec-03
Jan-04
Feb-04
Mar-04
Apr-04
May-04
Jun-04
Jul-04
Aug-04
Sep-04
Influent
Cumulative

Chart 14


Combined Performance EW-1, EW-2, EW-3
Groundwater Pumped (billions of gallons)
TCE Removed (thousands of pounds)
0
2
4
6
8
10
12
0
10
20
30
40
50
60
70
Jul-94
Jul-95
Jul-96
Jul-97
Jul-98
Jul-99
Jul-00
Jul-01
Jul-02
Jul-03
Jul-04
Gallons Water
Pounds TCE

Attachment 5

Interview Report

INTERVIEW RECORD

Site Name: Sturgis Municipal Wells		**EPA ID No.: MID980703011**	
Subject: Sturgis Municipal Wells Five Year Review		**Time:**	**Date: 9/27/2004**
Type: Telephone X Visit Other **Location of Visit:** On-site at the Levelor 800 Center		Incoming Outgoing	
Contact Made By:			
Name: Robert L. Franks	**Title: Project Manager**	**Organization: Michigan Department of Environmental Quality**	
Individual Contacted:			
Name: Mike Miller	**Title: Site O&M Manager**	**Organization: Environmental Health and Safety Outsource Services**	
Telephone No: **Fax No:** **E-Mail Address:**		**Street Address:** **City, State, Zip:**	

Summary Of Conversation

This interview was conducted as part of the five-year review process. Mr. Miller is the person that is in charge of operating and performing regulatory compliance activities for all of the remediation components associated with the site. Mr. Miller indicated that he is pleased with the performance of the groundwater pump and treat systems. He said that the systems are user friendly; that the automation built in allows for remote monitoring. Built in autodialer is very helpful.

Mr. Miller stated that he is generally on-site three days per week. Two for visual and audio inspection, one to lubricate systems and perform documentation activities and inspect outfall. NPDES sampling once per month.

Air sampling between carbon vessels is done once per month. When VOCs are detected between the vessels, he changes out the first unit. EW-1/EW-3 system has one carbon change out every ten months. EW-2 is 3 to 4 times per year.

Mr. Miller told me that influent VOC concentrations are:
EW-1 - 150-175 ppb
EW-2 - 500 600 ppb
EW-3 - mid-200 ppb

Mr. Miller described the process of acid cleaning of the towers. Takes two semi tankers of muriatic acid. Is concerned about the potential for large acid spills, particularly at EW-1/EW-3 because it is a residential area. We discussed the possibility of using an additive. Discussed asking DEQ Water Division for advice.

Regarding system uptime, Mr. Miller told me that the only significant down time for the systems was when lightning struck the EW-1/EW-3 system last summer. Destroyed the system controls. Couldn't purchase parts because of their age. Ended up replacing all of the controls. Is good in a way because now both systems have identical controls.

Attachment 6

Copy of Public Notice

DEQ

Second 5-year Superfund Review

MDEQ and U.S. EPA review

Sturgis Municipal Wells Superfund Site
Sturgis, Michigan

Over the next three months, the Michigan Department of Environmental Quality (MDEQ) and the U.S. Environmental Protection Agency (EPA) will review site progress at the Sturgis Municipal Wells Superfund Site in Sturgis, Michigan. The Superfund law* recommends regular reviews of sites (at least every 5 years) when a long-term cleanup remedy is in place. These reviews are done to ensure the cleanup continues to protect human health and the environment.

This review will include an evaluation of background information, cleanup requirements, extent of sampling, effectiveness of the cleanup, and any anticipated future actions. Once the review is complete, a five-year review report will be available for public review and comment at the Sturgis Public Library, 130 N. Nottawa, Sturgis, MI 49091.

Cleanup actions to date at this Superfund site, have included: removal of chemicals in soil at the former Kirsch Company Plant #1, extraction and treatment of contaminated groundwater with discharge of the treated water to storm sewers; and a minimum of a 30-year groundwater monitoring program.

For more information about the review and report, please contact:

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(517) 335-3392; or
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(312) 353-2886

** **CERCLA/SARA:** Comprehensive Environmental Response, Compensation, and Liability Act of 1980 PL 96-510 (CERCLA).*

Robert Franks
<franksrl@michigan.gov>
05/10/2005 07:41 AM

To

Subject Sturgis 5-year review

** Low Priority **

Pablo, last week I sent you the revised five-year review for the Sturgis site. Please do not put that document through signoff to Rick Karl. I would like to have you review the document again. If you have no further comments, please let me know that. At that point I will send a clean copy of the report through my Division Chief, Andy Hogarth and he will send it directly to Rick Karl.

I wasn't aware that this process was being followed, but it was made clear to me that this is the way we need to facilitate the signing ceremonies.

So, I need to hear from you whether or not you have additional comments. If you have more comments, we can work together to incorporate them. If you have no further comments we'll finalize the document on our end.

Thanks.

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